206-CD-001-002

EOSDIS Core System Project

Version 0 Analysis Report for the ECS Project

Final

February 1995

Hughes Applied Information Systems
Landover, Maryland

Version 0 Analysis Report for the ECS Project

February 1995

Prepared Under Contract NAS5-60000
CDRL Item 026

APPROVED BY

Peter G. O'Neill /s/ for	2/14/95
Marshall A. Caplan, Project Manager EOSDIS Core System Project	Date

Hughes Applied Information Systems
Landover, Maryland

206-CD-001-002

This page intentionally left blank.

Preface

This document is a formal contract deliverable with an approval code 2. As such, it does not require formal Government approval, however, the Government reserves the right to request changes within 45 days of the initial submittal or any subsequent revision. Changes to this document shall be made by document change notice (DCN) or by complete revision.

Once approved, this document shall be under the ECS Project Configuration Control. Any questions or proposed changes should be addressed to:

Data Management Office
The ECS Project Office
Hughes Applied Information Systems
1616 McCormick Dr.
Landover, MD 20785

This page intentionally left blank.

Abstract

The Earth Observing System Data and Information System (EOSDIS) Core System (ECS) is a 10-year project involving the collection and distribution of data from space and ground based measurement systems to provide the scientific basis for understanding global change. Using ECS as their window to the EOSDIS, the international science community is able to access data from a distributed archive in the United States and from other international Earth Science support systems. To accomplish this mission successfully, it is necessary for ECS to build on existing systems such as the EOSDIS Version 0 system currently being developed and deployed. Version 0 is a prototype system that will have operational elements that are accessible by the science community.

The purpose of this Version 0 Analysis Report is to document the analysis of the EOSDIS Version 0 design and provide recommendations for the degree to which the Version 0 design should be incorporated into the ECS. This report documents the activity and provides the rationale for all recommendations regarding the incorporation or omission of the Version 0 design elements.

This page intentionally left blank.

Change Information Page

List of Effective Pages	
Page Number	**Issue**
Title	Final
iii through xii	Final
ES-1 through ES-2	Final
1-1 through 1-4	Final
2-1 through 2-4	Final
3-1 through 3-10	Final
4-1 through 4-42	Final
5-1 through 5-12	Final
6-1 through 6-10	Final
A-1 through A-36	Final
B-1 thorugh B-42	Final
AB-1	Final

Document History			
Document Number	**Status/Issue**	**Publication Date**	**CCR Number**
194-206-SE2-001 206-CD-001-002	Original Final	May 1994 February 1995	95-0100

This page intentionally left blank.

Contents

4. Applicability of EOSDIS Version 0 to ECS

5. Integration of V0 in ECS

6. Version 0 Process Integration

Figures

Tables

Appendix A. Version 0 Functional Analysis Matrix

Appendix B. Version 0 Functional Analysis Matrix

Abbreviations and Acronyms

Executive Summary

The Version 0 Analysis Report is the culmination of work by the ECS Version 0 Analysis Team, supported heavily by the DAAC Version 0 staff and the ECS DAAC liaisons. The analysis gathered in this report provides a unique insight into many aspects of Version 0. This study has provided a reliable assessment of the scope of V0, the applicability of Version 0 to ECS, and the effort involved in integrating Version 0 into ECS. The assessment is complete at this time for Release A, although the analysis of applicability is ongoing. As a "living document", later releases will continue to define and refine applicable items allowing for timely integration of the V0 components viewed as having a high potential for use within the ECS.

The reader should be cautioned that much of the information produced in the SDR version of this report has not been included here. The sheer size of this document suggested allowing readers to focus on new material and not repeat previously published material.

Five Version 0 component types have been identified for potential incorporation into the ECS: Hardware, Software, Design, Experience and Process. Advantages of the integration of hardware and software include lower risk and an earlier release schedule. This advantage must be examined against the full life-cycle cost to insure long-term maintenance and operations cost do not exceed initial cost savings. Another factor regarding hardware and software was consideration of the ECS performance and reliability requirements. The benefits of design integration have been evaluated against the potential limitations of a particular implementation. An advantage of building on an accepted design, is that it can lower the risk of useability.

The experience and processes that were identified by the Version 0 Team have incalculable value for ECS development. By applying this analysis to the ECS architecture the development of ECS components will benefit greatly.

The facors which have been used to evaluate each Version 0 component include:

- Change (evolvability, modularity, cohesion, delta life cycle cost, key decision points, scalability, expandability and autonomy)
- Useability (science orientation, ease of use, consistency, acceptability)
- Data Integrity (controllability, maintainability)
- Robustness (RMA, graceful degradation)
- Ease of Management (M&O operability, controllability, maintainability, monitorability)
- Key Issues and Risks (risk, technology growth path)
- Requirements Satisfaction
- Costs and Cost Sensitivity (relative life cycle costs, driver and sensitivity)

The first phase of information gathering has been completed and the information presented within this document at this phase of its life cycle has been repeatedly verified for completeness and accuracy.

The SDR Version of this document had many software and design components identified for integration into VI. The science community drove the ECS architecture to be radically modified to a more open, extended service provider system. This has resulted in a smaller amount of software/design components identified for reuse.

Preliminary analysis indicates that building ECS on the operational Version 0 baseline is possible but very expensive. Discussions with both project personnel and the Version 0 Team have led to the conclusion that there is a solid rationale for not building on Version 0 as an operational base. Rather, three strategies for integration of Version 0 components are currently under review: enveloping, sharing, and interoperating. The differences between these three strategies are in the degree to which the component is integrated into ECS. Each strategy has advantages and disadvangtages which must be weighed against the full life cycle of the program. At this point component integration is attractive and potentially cost effective. At this time there are no components targed to be enveloped. ECS and Version 0 are planning on sharing the use of the V0 client for Release A. Our intent, at this time, is to provide the users with a graceful evolution from V0. Section 5 discusses our plan to integrate V0 and ECS in Release A for a complete Version 1 system.

1. Introduction

1.1 Identification

This Version 0 Analysis Report (VAR) Contract Data Requirement List (CDRL), whose requirements are specified in Data Item Description (DID) 206/SE2, is a required deliverable under the Earth Observing system Data and Information System (EOSDIS) Core System (ECS), Contract (NAS5-60000). The contractual requirement for this document was a single release document. Since this document is delivered at SDR in 1994 before the operational time frame of Version 0, ECS has volunteered to release this document in versions over the lifetime of Version 0.

1.2 Scope

The scope of the Version 0 Analysis Report is to document the analysis of the EOSDIS Version 0 design and provide recommendations for the degree to which the Version 0 design has been incorporated into the ECS. This report documents the activity and provides the rationale for all recommendations regarding the incorporation or omission of the Version 0 design elements.

The reader should be cautioned that much of the information produced in the SDR version of this report has not been included here. The sheer size of this document suggested allowing readers to focus on new material and not repeat previously published material.

The Version 0 Report documents the work performed under the Version 0 Analysis Task. The scope of Version 0 analysis, as identified in the EOSDIS Core System Statement of Work, specifies that

> "...the contractor shall examine Version 0 results and experiences and perform an analysis of Version 0 that documents:
>
> a. The standards recommended by the contractor such as user interface, data formats, data packaging, metadata content, etc.;
>
> b. The products handled by each DAAC, including projections for additional future data;
>
> c. The metadata and browse data describing the data products at each site and their compatibility with recommended ECS standards;
>
> The Contractor's ECS design shall specifically address how and to what extent EOSDIS Version 0 data, concepts, approaches, standards, hardware, software, etc. will be incorporated into the ECS."

This document records the Version 0 analysis process, the implementation, and the results of the analysis task. Some of the results mentioned above, from the ECS Statement of Work, are

documented in other areas of ECS design. Where applicable, they have been included as a appendixes to this document.

The standards for the user interface have been refined as a result of analysis of several of the DAAC IMS user interfaces as well as the ESDIS system level IMS. The recommendations for ECS specific user interface implementations will be documented in the User Interface Style Guide White Paper released June 1994. Specific results of the user interface analysis relative to Version 0 are documented in this report.

The products handled by each DAAC are identified in the Science Data Plan produced by the ESDIS project office. The Science Data Plan was not yet published at the time the ECS Statement of Work was written. Additional information about Version 0 data, beyond what is currently available in the Science Data Plan, is documented and available upon request This information was acquired through the support of the ECS site liaisons, User Services Personnel and IMS personnel at each of the DAACs. The ECS team is providing the information to Matt Schwaller for possible incorporation into the Science Data Plan.This version of the Version 0 Analysis Report responds to the following RIDS (see Table 1-1).

Table 1-1. SDR RID Responses

SDR RID number	Section number of Response	Comment
00466	4.3.1	
00592	4.3.1	
00660	Entire Document	Section 5 (TBR-PDR) will address this further.
00691	Executive Summary	
00781	4.2	
01024	Entire Document	
01045	Entire Document	Section 5 (TBR-PDR) will address this further.
01195	Entire Document	Section 5 (TBR-PDR) will address this further.

1.3 Background

The ECS team has selected, with government approval, to broaden the scope of the analysis to include some DAAC activities beyond Version 0 funding. This allows for a more complete analysis of existing functionality and design elements at the DAACs.

1.3.1 Version 0

EOSDIS Version 0 is the collection of DAAC-based Earth science data systems (generally IMS and DADS with some PGS capabilities, some existing and now enhanced, some new) with a major new integrating element, the Version 0 IMS, new data sets (e.g. from the Pathfinders), and enhanced user support (especially coordination of user support across the DAACs). Version 0, to

be available in to the science community in July 1994, is a working prototype with some operational elements.

The Version 0 IMS will provide the first “Earth science view” to interdisciplinary users, a consistent and coherent view of the aggregate dataset holdings of the DAACs, spanning traditional Earth science disciplines. Each DAAC will also continue to provide services tailored to meet the needs of its own discipline specific user community. Version 0 will support pre-EOS flight missions such as UARS, SeaWiFS, ERS-1/2, JERS-1, RADARSAT, TOPEX/Poseidon, and NSCAT/ADEOS.

1.3.2 Version 1

EOSDIS Version 1 will consist of the ECS and other elements that supplement the ECS. The ECS will provide common functionality across DAACs to serve interdisciplinary users. The ECS will be supplemented as necessary by DAAC-unique extensions. Some Version 0 elements may be included in the ECS or implemented as DAAC-unique extension to the ECS. DAAC-unique functions will provide unique processing, archive, or information management elements required by the DAACs specialized science community. The system will be capable of processing all existing and incoming identified NASA Earth science data.

1.4 Status and Schedule

The Version 0 Analysis Document has the following release schedule (Table 1-2):

Table 1-2. Version 0 Analysis Report Release Schedule

Date	Release	Major Accomplishments
2/94	First Draft	Identification of V0 Analysis Plan Process to date
5/94	First publication	Identification of major reuse candidates
2/94	Release A Version; Segment White Papers	Identification of Release A reuse components Identification of integration Plan for those components Mapping of components to ECS architecture elements.
Release n PDR	Release n Version	Identification of Release n reuse components Identification of integration Plan for those components Mapping of components to ECS architecture elements.

1.5 Document Organization

Section 2 identifies formal and informal documents related to the Version 0 Analysis effort. Section 3 describes the process used to gather information about Version 0 functionality and analyze it for applicability to ECS. Section 4 describes the applicability of Version 0 system level and DAAC unique components to the ECS architecture. Section 5 identifies where the V0

design components map into the ECS architecture. Section 6 provides overall recommendations learned from the analysis task. Appendices A and B contain the Functional Analysis Matrix, which lists all SDPS and CSMS functions for ECS along with a summary of corresponding Version 0 functions.

2. Related Documentation

2.1 Parent Documents

The following documents are the parents from which this document's scope and content are derived:

308-CD-001-003	Software Development Plan for the ECS Project
420-05-03	Goddard Space Flight Center, Earth Observing System (EOS) Performance Assurance Requirements for the EOSDIS Core System (ECS)
423-41-01	Goddard Space Flight Center, EOSDIS Core System (ECS) Statement of Work
423-41-02	Goddard Space Flight Center, Goddard Space flight Center, EOSDIS Core System (ECS) Functional and Performance Requirements Specification

2.2 Applicable Documents

The following documents are directly applicable to this document. In the event of conflict between any of these documents and this one, this document shall take precedence.

none	Goddard Space Flight Center, Science Data Plan for the EOS Data and Information System Covering EOSDIS Version 0 and Beyond
none	Goddard Space Flight Center, EOSDIS Version 0 to Version 1 Transition Plan, by Hunolt, Greg
none	Goddard Space Flight Center, Operations Guide for Monitoring the EOSDIS V0 Network

2.3 Information Documents

The following documents amplify or clarify the information presented in this document.

DAAC Documentation

The DAACs were very generous in providing information to support the Version 0 Analysis Process. Table 2-1 identifies supporting documentation provided by the DAACs.

Table 2-1. DAAC Documentation (1 of 2)

DAAC	Document Titles
ASF	ASF FY 94 Proposal Operations Concepts for the RADARSAT, ERS-2, JERS-1, ERS-1 ERA (draft) December 1993
EDC	EDC FY 94 Proposal EDC data summary National Landsat Archive Production System DORRAN/PCS System Design Document November 1993
GSFC	GSFC FY 94 Proposal GSFC V0 DAAC Product Specification Concept Document - Build 1 September 1992 GSFC DAAC Metadata Submission Guide October 1992 GSFC V0 DAAC System Analysis September 1992 GSFC V0 DAAC System Design October 1992 GSFC V0 DAAC Software Development Policies and Procedures November 1992 GSFC V0 DAAC System Development Effort and Approach NASA GSFC 1993 Conference on Mass Storage Systems and Technologies GSFC V0 DAAC presentation
JPL	JPL FY 94 Proposal Quality Assurance Software Requirements March 19, 1992 Software Requirements Document Phase I: Topex/Poseidon (preliminary) Sept. 1992 Design of the quick look bulletin board for Topex/Poseidon data May 1992 ADP Equipment Acquisition Plan, JPL DAAC May 1993 ADP Equipment Acquisition Plan JPL DAAC March 1992 PODAAC Version 1 Release 1 System Description Functional Requirements Document Sys I&T Plan - 1 Phase 1: Topex Sept. 1992 Sys I&T Plan - 2 Sys I&T plan reports - 3 October 1992 Software Requirements Document Version 1.0 March 1992 PO.DAAC PGS Software Spec. for the Merged GDR CD-ROM Header File, Cycle Header File, and Pass File Version 1.0 September 1993 ERS-1 Data Management Plan January 1992 Sys I&T Plan - 2 Sys I&T reports - 3 phase 2: Topex observation October 1993 Sys I&T Plan - 1 Phase 2 date unknown
LaRC	LaRC FY 94 Proposal LaRC DAAC Handbook Development Strategies and Lessons Learned from the Langley Information Management System Data Set and Grenule Names Lessons Learned

Table 2-1. DAAC Documentation (2 of 2)

DAAC	Document Titles
MSFC	MSFC FY 94 Proposal The Use of the Hierarchical Data Format (HDF) with Special Sensor Microwave Imager (SSM/I) Earth Sciences Requirements and Implementation Plan Revision A March 1993 EOSDIS Master Data Management Plan August 1993
NSIDC	NSIDC FY 94 Proposal 1994 Work Statement August 1993

Other Documentation

193-WP-136-002	Version 0 Data Migration and Translation Tool Analysis
194-WP-901-002	EOSDIS Core System Science Information Architecture
222-TP-003-005	Release Plan Content Description
420-TP-001-005	Proposed ECS Core Metadata Standard Release 2.0
none	Goddard Space Flight Center, EOSDIS Version 0 (V0) Lessons Learned, Version 1.0
none	Version 0 Client Reuse
none	V1 Data Migration
none	Identifying and Qualifying Reusable Software Components, *IEEE Computer Magazine*

This page intentionally left blank.

3. EOSDIS Version 0 Analysis Process

Version 0 (V0) Analysis includes three phases. The first phase is the gathering of information to gain a thorough understanding of all aspects of Version 0 as a system. The second phase includes more detailed analysis of specific Version 0 components for integration into ECS. The third phase identifies how the component is integrated into the ECS development cycle. Section 3.1 Summarizes the potential for Version 0 component integration. Section 3.2 provides definitions for component integration into ECS. Sections 3.3 through 3.5 describe the three phases of Version 0 Analysis in detail.

3.1 Potential for Version 0 Integration

Based on the detailed analysis of Version 0 and our current ECS architecture, we have estimated the potential for reusing Version 0 components to develop ECS. Figure 3-1 illustrates the maximum potential integration of Version 0 components. It is intended to show that if all of Version 0 were integrated into ECS that V0 covers only a portion of the functionality ECS is to provide. For example, if all of the Version 0 CSMS components were integrated it would only map to a small percentage of the CSMS functionality required for ECS. Additional functionality required for the ECS CSMS system includes extensive network monitoring, local and system management capabilities as well as a high reliability factor.

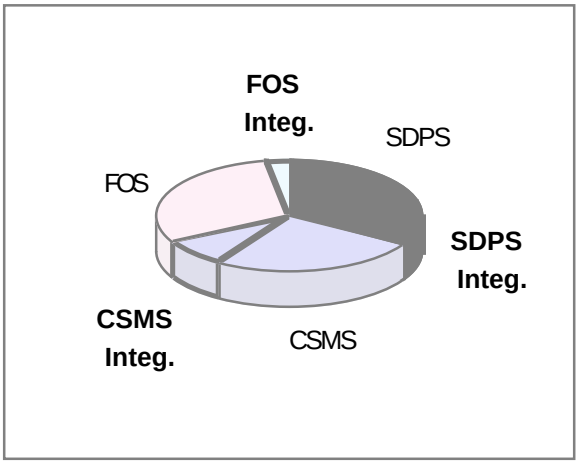

Figure 3-1. Maximum V0 Integration Potential for FOS, CSMS and SDPS Segments

We estimate minimal reuse potential for FOS. In CSMS we estimate a small potential for reuse, mainly in hardware reuse such as routers. The largest potential reuse occurs for SDPS owing to the extensive IMS and DADS focus in Version 0; this is mainly experience reuse.

Preliminary Analysis indicates that building ECS on the operational Version 0 baseline is possible but very expensive. The rationale for not building on Version 0 as an operational base is based on several factors as described below. Discussions with both project personnel and DAAC Version 0 developers have led to this conclusion.

Each DAAC has implemented the system in a different manner. This means that the ECS operational baseline would support many potential different implementations of similar functionality. The cost of maintaining many unique architectures is high. An example of this is the interface between the system IMS and DAAC unique IMS(s). Any change to this interface requires each DAAC to implement the corresponding change to their IMS implementation. Similarity in implementations can provide considerable life cycle cost savings while not precluding DAAC unique extensions for specific functionality.

In response to science community and NASA direction, and as a result of post-SRR discussions and analyses, the ECS project has developed what could be interpreted as a "mandate" from the scientific community to develop a new conceptual architecture capable of meeting the needs. Together, the elements of the mandate comprise the building blocks for an evolvable system.

That mandate is summarized in the following set of system design guidelines.

- To move from product approval and ordering towards product publishing and access
- To move from Metadata/data distinction towards a seamless view of all data.
- To move from a limited provider implementation towards an extended provider implementation
- To move from a homogeneous, centrally managed system towards heterogeneous, autonomous system components.

These architecture concepts currently are being developed into a system design that was presented at the System Design Review (SDR) and will be presented in further detail at the Preliminary Design Reviews (PDR).

The DAACs have not implemented Version 0 using such an architectural framework. The Version 0 IMS do not allow the users to “query the data” directly. The data server concept allows similar types of data to be grouped together for efficient searching mechanisms and efficient use of storage technology. EDC has implemented a similar architecture for the metadata with good success. Version 0 has not implemented the same type of architecture for the data. The use of Application Programming Interfaces (APIs) provides the DAACs (and other data clients/servers) to access ECS functions at varying levels of interface. This provides the capability of DAAC unique extensions (customized user interface, search features, etc.) to the core system.

The rest of this report focuses on different aspects of Version 0 component integration including hardware, software, design, experience and process integration. The Version 0 Analysis Team has expectations for the potential risk reduction by using Version 0 component integration to develop ECS.

3.2 Building from Version 0

3.2.1 Integration Candidates

This study broadens integration of Version 0 to more than hardware and software. The Version 0 Analysis Team has placed equal import on understanding aspects of the Version 0 development process and how they can support ECS development. Five Version 0 component types have been identified for potential integration into ECS: Hardware, Software, Design, Experience, and Process. Each function of Version 0 has been analyzed for component integration into ECS. For example, the LaRC user interface was analyzed for software, design, and experience integration. Table 3-1 identifies Version 0 component types and examples of potential integration into ECS. We have looked at a range of components from small components such as subroutines to large components such as archives systems and the V0 network.

Table 3-1. Examples of Potential Integration of Version 0 Components into ECS

Version 0 Component Type	Examples of Potential Integration into ECS	Where Documented
Hardware	Reuse of archive at a DAAC Simultaneous use of hardware with Version 0	V0 Analysis Report
Software	Orbital model from EDC IMS (and ESDIS IMS)	Quality Office Experience Factory (also in this report)
Design	Version 0 and LaRC user interface Version 0 Interoperability standards	EP3 and EP4 documents
Experience	UniTree lessons learned	FSMS Trade Study
Process	Data migration plans developed at MSFC, LaRC, and GSFC	V1 Data Migration White Paper

Advantages of integration of hardware and software may include lower risk and earlier release schedule. The integration of an archive system may postpone (or eliminate) the need to physically migrate data from V0 to ECS. However, this apparent advantage must be examined against the full life-cycle cost to ensure that long-term maintenance and operations costs do not exceed the initial cost savings. In addition, integration must consider existing ECS performance and reliability requirements.

Integration of design can potentially lower risk by reusing accepted designs. The advantage of building on an accepted design is that it can lower the risk of useability. Working with the V0 developers, the ECS team can possibly add new functionality to an existing design rather than start from scratch. The benefits of this type of integration has to be evaluated against the potential limitations of a particular implementation. For example, use of the Version 0 Interoperability interface may limit the functionality of searching on data set unique attributes.

Integration of experience and process into the ECS development can provide tangible benefits. The challenge is to work with the DAAC staff to understand the DAAC operations sufficiently to capture all the possible instances and to ensure proper integration.

3.2.2 Methods of Integrating Components into ECS

Three types of integration of V0 components into ECS have been identified: enveloping, sharing, and interoperating. Components which can be enveloped or shared are generally hardware and software components. The “control” (Operations, Maintenance, etc.) is always the responsibility of the DAAC, but within the DAAC it is expected that there is both an ECS and a Version 0 aspect. The selection of an integration method will be mutually agreed upon with the project office, the participating DAAC, and the ECS team.

3.2.2.1 Enveloping Components

The enveloping of a Version 0 component connotes the use of that element as an ECS design element. The component is included as part of the ECS architecture, conforms to ECS standards, and is the responsibility of the ECS M&O organization. Version 0 may retain access to the component through an agreed upon ECS interface. An example of this is a mass storage system which may be enveloped into ECS. This could provide a cost benefit option instead of “migrating” data from V0 to V1. The mass storage system would be the responsibility of the ECS organization which would ensure the operational readiness. Version 0 could maintain access to the mass storage system either through their current interface or via an ECS developed API. Either interface would be agreed upon by both partners and documented in the appropriate ECS IRD. The performance requirements of the mass storage system (reliability, maintainability, etc.) would have to be analyzed on a case by case basis to determine the degree that they differ from ECS requirements.

Another example would be the envelopment of a software subsystem which would be maintained by the ECS staff. An example of this is integrating portions of the Land Analysis System (LAS) from USGS. The software would be maintained by the ECS staff for the life of the software. No components of Version 0 are targeted envelopment at this time

3.2.2.2 Sharing Components

The sharing of a Version 0 component connotes that the DAAC(/ESDIS) provide a minimum access to the Version 0 component.. Operational responsibility of the component remains with the original owner (Version 0). An example of this is a Version 0 mass storage system that the Version 0 management provides ECS with direct access to. This may be an efficient means of providing quick access to data. The DAAC management would determine the availability of the resource between ECS and Version 0. Sharing may be used as an initial step towards enveloping a component. The DAAC and ECS would reach agreements as to the availability of the resource (disk space, access time, priority) by ECS. ECS makes no claims for performance or reliability of shared components.

Sharing of components may require additional software to encapsulate the Version 0 component so that it can appear to be part of the ECS configuration. The current ECS contract does not provide for design or development of this software. The assumption is that, if sharing is determined to be an advantage to the project, that the interface would either be covered by WBS 1.7 funds or that the interface would be treated as an ADC. Section 5 discusses sharing of V0 components in the Release A timeframe.

3.2.2.3 Interoperating With Components

Being Interoperable with a Version 0 component connotes that protocols exist to send and retrieve messages between ECS and the Version 0 component. Operational responsibility of the component remains with the original owner (Version 0). Version 0 does not make any agreements as to operational availability of the component. An example of this is ECS access to the Version 0 IMSs at each DAAC. The ability to send and retrieve messages exists via use of existing Version 0 protocols for inventory search. However, the DAAC does not guarantee that the V0 IMS will be operational during certain hours, nor that the V0 IMS will have the resources available to respond to the ECS request.

Table 3-2 summarizes the Integration types and the features of each type.

Table 3-2. Summary of Integration Types

Type	Control	Access	Features
Enveloping	ECS	Version 0 ECS	V0 component becomes ECS component Interface to Version 0 may be maintained via existing interface or API.
Sharing	Version 0	Version 0 ECS	DAAC/ESDIS guarantees access by ECS system Interface defined in V0 IRD (TBR)
Interoperating	Version 0	Version 0 ECS	Interface defined in V0 IRD

3.3 Information Gathering

The first phase of the Version 0 Analysis Task was to gather material on each of the design elements. This has been accomplished through a variety of methods. The Version 0 Analysis Team is composed of personnel from each segment as well as from the system engineering, science, and M&O offices. The documentation listed in Section 2 has been analyzed and key points extracted for further research. Site liaisons at each of the DAACs have provided additional information and points of contact at their sites. The DAACs have had an active role in the Version 0 Analysis by providing information, reviewing information, and supplying their time and effort in support of the identification and analysis of integrating components.

The documentation of the Version 0 baseline has been primarily through the Functional Analysis Matrix (FAM). A complete listing of the FAM is provided as an appendix. The left column of the matrix identifies the major functions that ECS will provide. This list was derived primarily from the Functional Requirements Specification (216/SE1). Along the horizontal axis are entries for each of the DAACs and the System level activities. Thus, for each cell of the matrix there is an entry describing if and how that DAAC (or system level task) performs the function indicated. Using this form of documentation the team has attempted to capture the similarities and differences between Version 0 activities at each of the sites. The FAM has provided a good basis for initiating discussion with the Version 0 development teams.

3.4 Detailed Analysis

Detailed analysis has involved interaction with the Version 0 development community to gain a complete understanding of the Version 0 functions. During this phase the ECS team member and Version 0 developer (or site liaison) attempted to identify the type of component integration (hardware, software, design, experience, process) The detailed cell information was completed for each cell in the FAM that was considered to have potential for integration into ECS. The detail cells were included in the SDR Version of the document.

Detailed information exists for many of the cells. The "detailed cell entries" describe: the current status of integration of that design element into the ECS, initial analysis results, who is responsible, the point of contact at the DAAC, and other relevant information such as resource requirements for evaluation of the design element. Figure 3-2 illustrates the relationship between the FAM and the detailed cells.

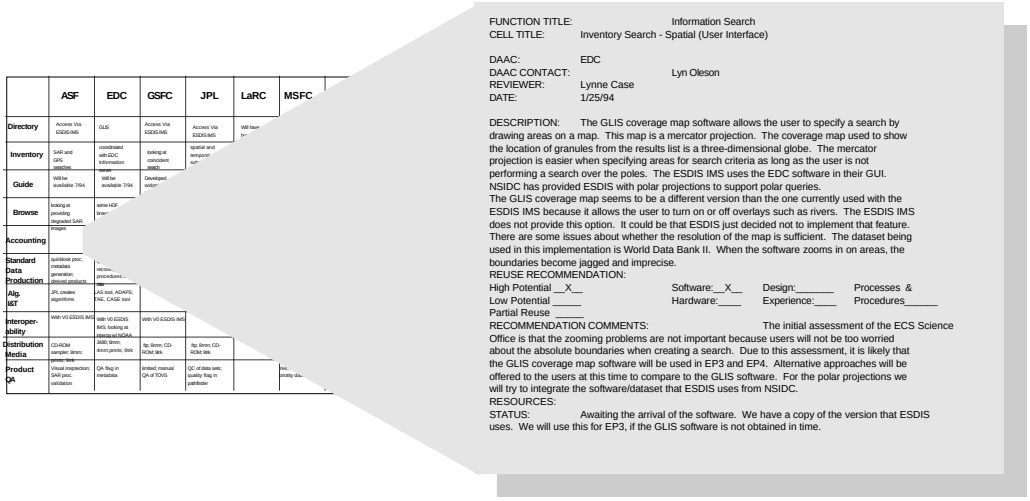

Figure 3-2. Sample Detailed Cell Derivation from FAM

3.4.1 Evaluation Process

The process of the evaluation of portions of V0 for potential integration into ECS is one that will evolve over time. At first the evaluation will largely be subjective, with a determination of integration potential only. As greater depth of knowledge of the details of V0 hardware and software is combined with further definition of the ECS architecture, a more objective evaluation will be possible. This series of evaluations will lead to decisions on the envelopment, sharing, and interoperability of appropriate V0 components.

The evaluation of three of the components (design, experience, and process) is performed through a combination of review of DAAC and V0 documentation, and personal interaction between DAAC and ECS personnel. Evaluation of hardware and software is also subjective to

some degree, but a more objective evaluation is desirable for these elements. In the interest of consistency, a common set of evaluation criteria are used across all V0 elements for all five components. These evaluation criteria appear in Appendix C, and provide the basis for the assessment of integration potential for these components.

3.4.2 ECS Evaluation Criteria

Strategies for evaluation of components are as follows:

- **Strategies for evaluation of hardware components for integration.** A set of hardware will be identified as the base set of ECS hardware to support the defined architecture. As overlaps are identified between what is needed for ECS and what is available from a DAAC Version 0 System, then ECS would investigate envelopment of those Version 0 components. An assessment will be made as to whether there is a need, whether it is cost effective, and whether it is feasible to support specific Version 0 hardware components that are outside the ECS base set of hardware. Section 4.3.1 of this report presents an analysis of the issues associated with envelopment of V0 components.
- **Strategies for evaluation of software components for integration.** ECS will use the objective criteria (used across all of ECS) to determine whether a software component meets the minimum standards identified for heritage software. The software will also be evaluated to determine whether it corresponds to the ECS design. If the software does not correspond to the ECS design, then it may still be used as the basis for ECS software with similar functionality. For example, if software for multiple data sets is tightly coupled then this may not fit in with the ECS data server design. However, it may be possible to extract needed functions from the software and to gain insight into data set specific problems and solutions.

  Some software such as utilities to read and write CDROMs are available at each of the DAACs. The strategy for evaluation of this type of software is to compare this similar software from each DAAC to identify the code that is the most robust in terms of functionality and error handling. Because ECS must serve a diverse set of DAACs, the software from multiple Version 0 DAACs may need to be combined to incorporate a comprehensive set of services and error handling.
- **Strategies for evaluation of design components for integration.** In addition to meeting criteria that is established for ECS, Version 0 design components with potential for reuse within each element will be evaluated against some of the same criteria that the ECS element design is measured. For example, the set of criteria that is documented in the EOSDIS DADS Design Issues slide presentation dated July 23, 1993. These slides summarize the aspects of a good DADS user-oriented design, a good DADS decentralized design, a good DADS expandable, evolutionary, and reusable design, a good DADS COTS-based and open system standards design, a good DADS robust design, and a good DADS operable design.

- **Strategies for evaluation of experience for integration.** Each area will provide opportunities to reuse experience. In many cases, the experience gained in Version 0 development is inherent in the software, design, and processes. Thus any software, design, or processes incorporated from Version 0 will include reuse of experience.
- **Strategies for evaluation of process for integration.** A process that is identified as being successful in Version 0 and has perceived applicability to ECS may be used as the basis for similar processes in ECS. Once such a process has been identified, the documentation that describes this process must be obtained and analyzed. If the Version 0 process is determined to be reusable within ECS, then the process will be incorporated and tailored as necessary.

3.5 Integration Plan

Each design element that has been identified for incorporation into ECS is coupled with a release. The coupling can be to an Evaluation Package, a formal release, or, in the case of a process incorporation, tied to a formal document. The Integration plan will also identify the mapping of reuse component to specific releases.

3.5.1 Hardware Integration

Integration of hardware will have to be considered on a case by case basis. In most cases integration will not involve any physical changes or new connections to the hardware. In those cases where their are physical changes that integration process will be done in accordance with accepted industry and government standards and practices.

Since most (if not all) of the hardware being reused from Version 0 will not be physically moved and will already be in operation, it is expected that equipment will be in good working order. Thus testing of the hardware will probably be limited what is normally done during operations.

3.5.2 Software Integration

Software reused from Version 0 will be treated as “heritage” code and will be tested in accordance with the guidelines established in the ECS Software Development Plan (308/DV1). Whenever possible, code that is integrated in to ECS will be regression tested using Version 0 Test Plans and Procedures.

3.5.3 Incorporation of Design

Since Version 0 is a prototype system, formal design documentation was purposely kept to a minimum. As a result, it will not be possible in most cases to lift design from Version 0 documentation. Instead, it will be necessary to discuss the design with Version 0 staff, and possibly “reverse engineer” the design from the code.

3.5.4 Reuse of Version 0 Processes and Procedures

Processes and procedures covers a lot of territory: From specific items such as quality checking of a data set to very broad processes such as the Version 0 evaluation process for new IMS functionality (i.e., the tire kickers). This section identifies how those processes and procedures will be integrated with ECS processes and procedures.

This page intentionally left blank.

4. Applicability of EOSDIS Version 0 to ECS

This section describes in detail the applicability of each of the five component types (hardware, software, design, processes and procedures, and experience) that comprise the Version 0 system from the perspective of Version 0. It is divided into subsections dealing with applicability to V0 System Level tasks, local IMS, DADS, and PGS functions, as well as issues related to system management, systems engineering, and maintenance and operations. Specific recommendations regarding the applicability of a particular piece of hardware or software are included here.

4.1 System Tasks

Version 0 is composed of system wide activities in addition to the DAAC specific activities described in section 4.2 and beyond. The system wide activities, such as User Services, encompass areas that span the individual DAAC boundaries and help provide a cohesive system element to Version 0. The system activities analyzed for the Version 0 Analysis Report include the ESDIS IMS functions, Version 0 Network, User Services, NCSA tool support, the Data Dictionary, and Human Machine Interface (HMI).

4.1.1 V0 ESDIS IMS Functions

The Version 0 ESDIS IMS provides for interoperability among the DAACs. It allows users to query metadata and order data from any of the DAACs from a single interface. A more complete description is provided in the Functional Analysis Matrix (FAM) in Appendix B.

4.1.1.1 V0 ESDIS IMS Summary

Table 4-1 contains a summary of the ESDIS IMS components that have been evaluated to this point. An initial assessment has been made to categorize the functions in the most likely type of integration. In future versions the functions may be further evaluated for other types of integration. More information about the current assessment of each component is represented in the ESDIS IMS Detailed Cells (SDR version of the V0 Analysis Report).

The information gathered for the analysis of the ESDIS IMS was gathered by attending the IMS team meetings, attending or reviewing minutes of the IMS telecons, and reviewing the software itself. ECS has one unrestricted account on the ESDIS IMS V0 development machine, killians. This account has been used to review the software as well as download some of the software to the ECS Landover facility for closer examination.

Table 4-1. ESDIS IMS Component Integration Summary

Candidate Function	Preliminary Assessment
Hardware	
none identified	
Software	
GUI and ChUI	Approximately 10% of the GUI will be reused in the EPs . The ChUI has not been assessed at this time.
Guide software	High percentage of the software can be reused.
Polygon spatial search	No reuse possible. Each DAAC handles polygon searches in a different manner. None of the implementations will provide scalability to the amounts of data in Release A and beyond.
Design	
User Authentication and Registration	The current user authentication approach suggested will not be robust enough for the increasing number of users of ECS.
IMS server cookbook	Concept will be reused for the IMS server API that will be provided to SCFs (virtual IMS) and others.
IMS Architecture	The ECS architecture already reflects some of the concepts incorporated in the V0 IMS such as site autonomy and heterogeneity.
Experience	
IMS Staff	ECS IMS staff will leverage knowledge of Hughes STX Version 0 development staff.
Data Dictionary	see section 4.1.5
Process	
Tirekicker Involvement	ECS evaluators have been involved in the design and evaluation of the IMS starting with EP4.

4.1.1.2 ESDIS IMS Component Integration

- **Hardware.** The ESDIS IMS is client software that currently resides on one host per DAAC (and selected tirekicker workstations). It communicates to ESDIS IMS servers that are potentially resident on other hosts within the DAAC. The host that the ESDIS IMS client software resides on is, in most cases, not a host dedicated to the client. There are other DAAC related applications that operate on the same host. A negotiation process occured with each DAAC for the installation of ECS IMS clients. It is possible that the clients can reside on the same hosts as other DAAC applications but it is up to the DAAC and the ECS contractor to determine the best location for ECS clients.
- **Software.** The ESDIS IMS software identified for integration as specified in Table 4-1 has already been re-hosted in the ECS Development Facility (EDF). This software will be modified to conform to the ECS naming conventions and integrated with the appropriate IMS release. The same procedure will be used for additional software as it is identified.

Polygon spatial search was studied to determine the possibility of inclusion into Release A and beyond. Polygon search is a desired feature but is was not in the Level 3 requirements baseline. The polygon search capability has been added as a Level 3 requirement as a result of the Version 0 work but will not be implemented in the same manner. The ESDIS IMS allows the user to select points on a map when defining a polygon search. The points are accepted and a rectangle is formed on the screen. When the search reaches the DAAC, it may be treated differently depending on the DAAC. Some DAACs (such as GSFC and EDC) will perform a search using the actual points passed to them. Other DAACs redfine the points to a minimum bounding rectangle. Consequently, the user does not know when the query returns, how accurate the results are in respect to the points that he/she selected. This approach cannot be used within ECS. For polygon searches to be useful, ECS would have to provide the capability for the user to define more points than Version 0 allows. Also, the user must be informed of exactly what the results imply from each data provider. Polygon searches with the increasing volumes in Release A and beyond will be very inefficient using the RDBMSs that the DAACs currently use.

- **Design.** The ESDIS IMS architecture has already been integrated into the ECS architecture to some degree. The overall architecture in the ESDIS IMS system consists of loosely coupled clients and servers. One of the primary lessons learned by the ESDIS IMS team is that the "intelligence" of the system, the active data dictionary and dependent valids, should not reside with the client. The data dictionary and valids information must be separately maintained in order for updates to be easily made. This lesson was incorporated into the Distributed Advertising Service in the ECS architecture. A more complete description of the integration of V0 and ECS client approaches is in section 5.
- **Experience.** The ESDIS IMS team and the ECS IMS team have been working as closely as their respective schedules will allow. The working relationship will become more embedded as the ESDIS IMS staff begins to transition to the ECS team by splitting their time between V0 and ECS. This occured when the ESDIS IMS development slowed down after Version 0 became operational and development decreased. Starting in March, the appropriate ESDIS IMS V0 staff has been attending the bi-weekly IMS meetings with the ESDIS project office. In April, some of the ESDIS IMS staff worked with the SDPS architecture team to provide lessons learned and system engineering support for the System Design Review. It is expected that the HSTX component of the V0 IMS team will relocate to the ECS Landover facility.
- **Process.** Science tirekickers and DAAC representatives were involved in the objectives and priorities as well as the evaluation of each release of the ESDIS IMS client. This process has been incorporated into the ECS Evaluation Package development process.

4.1.2 V0 Network and Information Services

The V0 Network team at GSFC has been engineering and setting up the V0 Wide Area Network (WAN) in preparation for operational use starting July 1994. This same group also manages V0 Information Services which serves the entire EOS community by providing such services as

Anonymous FTP and the EOSDIS Bulletin Board Service. There have also been Local Area Networks (LANs) set up by DAAC network personnel. Sections 4.1.2.1, 4.1.2.2 and 4.1.2.3 discuss how all of these network related services can be incorporated into V1.

4.1.2.1 V0 Network Services

There are two parts to V0 Networks, consisting of the WAN and LAN portions. The WAN portion is the DAAC-to-DAAC network designed and managed by the V0 network team out of GSFC, while the LANs are local to the DAACs and are managed by DAAC personnel.

4.1.2.1.1 Summary

Various types of integration have been looked at as summarized in Table 4-2. Even though hardware and software are the obvious items to look at, experience, design and processes are just as important especially in the networking area. For example, the experience of the V0 Network team is very valuable in resolving network issues with DAAC, institutional network, and NASA support organizations such as NSI (NASA Science Internet) and PSCN (Program Support Communications Network).

Table 4-2. Network Services Component Integration Summary (1 of 2)

Candidate Function	Preliminary Assessment
Hardware	
Routers	All primary routers will be reused.
Circuits	All circuits will be used with bandwidth enhancements done as needed.
LAN Network Components	LAN components such as bridges, hubs or repeaters are being identified (if they exist). Reuse of these devices will depend on final DAAC LAN locations and configuration.
Software	
Custom software used for performance monitoring.	Functions currently supported by custom v0 network monitoring software are supported by network management COTS software (e.g. Openview). Procedures and experience are important.

Table 4-2. Network Services Component Integration Summary (2 of 2)

Design	
WAN design	Will be re-engineered as necessary.
LAN design	V0 LANs are designed and setup to conform with center or campus networking environment. V1 LANs will have to do the same so there can be lessons learned from V0.
Experience	
Dealing with NASA support organizations such as PSCN and NSI	The experience of the V0 Network team is quite significant. One way of transferring that experience base is by 'shadowing' V0 network team activities.
WAN troubleshooting	This is also an area that valuable experience can be obtained from the V0 Network team
User support issues	Experience gained in providing help not only for the end user but also DAAC network personnel by the V0 network team is important.
Interaction with campus or institutional network personnel at each site hosting a DAAC	This experience which is again mainly found from the V0 Network staff is valuable for ECS
Process	
Process for getting bandwidth upgrades and new circuit establishments	V0 experience in dealing with PSCN is useful.

4.1.2.1.2 Component Integration

WAN routers and circuits will be enveloped, but not in one step. There will be a sharing phase between ESN (EOSDIS Science Network) and the V0 Network. The dates and timeline for the different phases are given in Section 4.1.2.3. It is expected that V0 routers will be able to handle V1 traffic since they are high end routers by today's standards. The circuits which are mostly fractional T1 links between the DAACs will be enhanced as needed.

Information has been gathered (an ongoing activity) on the LANs at the DAAC sites. Most of the networks at the DAAC sites are Ethernet based and simple (except for the network at the GSFC DAAC where there is an FDDI based LAN in addition to Ethernet). Depending on the DAAC site, a LAN network infrastructure may be incorporated or totally replaced by ECS designed LANs.

The V0 team conducts performance analysis by gathering statistics from hosts monitored by the V0 Network. Statistics on free memory, number of users, number of runable jobs, bytes per day transferred on links between sites, and time required for pings between sites is gathered using codes (and scripts) developed by the V0 Network team. A report is generated every month showing trends. The performance analysis utilities used by V0 were evaluated and it has been

determined that for the most part a nework management software like HP Openview (currently used for EPs in ECS) does the job. Functions not supported by default can be realized via extensible agents and vendor specific MIBs (Management Information Base) and/or use of utilities similar to those developed by V0. In order to verify this, CSMS has done some testing using HP Openview and the results are in line with the performance analysis work done by the V0 team.

There is an ongoing working relationship with the V0 Network and Information services group that will result in considerable experience sharing by the V0 network team. For example network traffic statistics is gathered at the Hughes ECS facility and compared with V0's monthly network performance reports.

4.1.2.2 EOSDIS Information Services

There are several information services that are currently being provided by the V0 Network team in support of the EOSDIS project. The following sections give a summary, V0 integration methods, and details on each service.

4.1.2.2.1 Summary

Table 4-3 gives a summary of V0 Information Services reuse candidates. Most of the components are public domain software. Even though there will be other public domain or commercial software that ECS may use at time of first release, the experience gained from providing the types of services listed in the table is quite important.

Table 4-3. EOSDIS Information Services Component Integration Summary(1 of 2)

Candidate Function	Preliminary Assessment
Hardware	
none identified	
Software	
Anonymous FTP	This is public domain software serving the EOSDIS. The version that is current at the time of V1 release (as configured by the V0 team) may be enveloped. See Section 4.1.2.3.4.
X.500 Directory Service	The version that is current at the time of V1 release (as configured by the V0 team) may be enveloped with changes and updates made as necessary. See Section 4.1.2.3.4.
Listserv	The version that is current at the time of V1 release (as configured by the V0 team) may be enveloped with changes and updates made as necessary. See Section 4.1.2.3.4.

Table 4-3. EOSDIS Information Services Component Integration Summary (2 of 2)

Candidate Function	Preliminary Assessment
E-mail Forwarding Utility	Some form of this service (whether or not it is done by this same software) should be considered. See Section 4.1.2.3.4.
Bulletin Board Service	The Evaluation Package (EP) process has looked at the V0 BB while in the process of evaluating BBS software for the EP BBS. It is expected that there will be some Interoperability between the EP and V0 BBS services leading to a single BBS. See Section 4.1.2.3.4.
Gopher Server	Currently the V0 team has set up a gopher server without any modification to the server software other than setup and configuration. See Section 4.1.2.3.4.
World Wide Web (WWW) Server	The WWW server setup and testing are in the early stages. See Section 4.1.2.3.4.
Design	
none identified	
Experience	
Setup and management of the information services for the EOS and NASA environment	Experience in this area can be useful since ECS should be interoperable with NASA wide implementations of information services (e.g. X.500 Service)
User support issues	Experience in supporting users (using the information services listed above) can also be very useful for V1.
Process	
none identified	

4.1.2.2.2 Component Integration

Section 4.1.2.3.4 discusses whether the services listed above will be incorporated in V1. It is likely that for the most part there will be an Interoperability and sharing phase to be followed by envelopment of a given service. It is better to think in terms of services as opposed to a given piece of software since by the time V1 is released a totally different kind of software product could be providing the same service that some software product is supporting now.

4.1.2.3 V0 to ECS Release A Network and Information Services Transition Plan

The ESDIS V0 to ECS Release A Transition Plan, provided by Greg Hunolt, included a transition proposal by the Version 0 (V0) Network team. The proposal suggested that the V0 network and services all be enveloped by ECS as part of Release A. This section addresses the issues raised in the proposal and outlines an appropriate transition procedure under the current release schedules.

The V0 Network, developed in preparation for operational use in July 1994 (see Section 4.1.2), includes the WAN circuits and routers that provide DAAC to DAAC and DAAC to ADC connectivity. The DAAC LANs on which V0 hosts reside are maintained primarily by DAAC personnel, with some management assistance from the V0 Network Operations Center (NOC). The V0 Network is considered to be a working prototype of the ESN WAN. The ESN Network, considered to be mission essential, will be developed by the Hughes ECS team and delivered in releases IR1, RA, RB, RC and RD. Full ESN capabilities (but not capacity) will be realized by RB.

Section 4.1.2.3.1 discusses V0 and Release A WAN architecture's and the transition process between them. V0 and Release A LAN architecture's and the transition process for the LANs are described in Section 4.1.2.3.2. Management and operations of the V0 and Release A networks and the transition between them including the time frame is given in Section 4.1.2.3.3. Section 4.1.2.3.4 discusses the topic of Information Services as provided by the V0 Network team along with issues to be addressed in deciding how best to incorporate the services into ECS.

4.1.2.3.1 V0 and Release A WANs

A. **Current V0 WAN Architecture and Capabilities.** The current V0 WAN links seven DAAC sites (ASF, EDC, GSFC, JPL, LaRC, MSFC and NSIDC), NOAA Suitland (an ADC) and the Hughes EDF. The links between the DAACs are PSCN-supplied fractional T1 circuits while links between GSFC, NOAA and Hughes EDF are commercial SMDS switched T1 circuits. Although the V0 team's responsibility ends at the V0 routers at each DAAC site, some hosts on the DAAC LANs are monitored for fault management and performance analysis purposes. The DAAC LANs are managed by local DAAC network personnel (see Section 4.1.2.3.2 below). Connectivity to the Internet is provided either by NSI (most cases) or the regional Internet service provider (e.g. Midnet) at the DAAC site. Figure 4-1 shows the current V0 WAN links and the corresponding circuit sizes (some of the link sizes are requested upgrades for 1994). The circuit sizes are upgraded from time to time as the bandwidth demand increases.

   The V0 WAN is managed by the V0 network team using a network management COTS software hosted at the GSFC NOC. Network performance and fault monitoring are among the network management activities that are performed by the V0 network team. The results from these activities are used, among other things to justify circuit size increases

The routers that are being used (both primary and secondary) at all of the sites are Cisco Routers. The AGS+ model is used for primary routers and the IGS or 3000 models are used for backups at most of the sites.

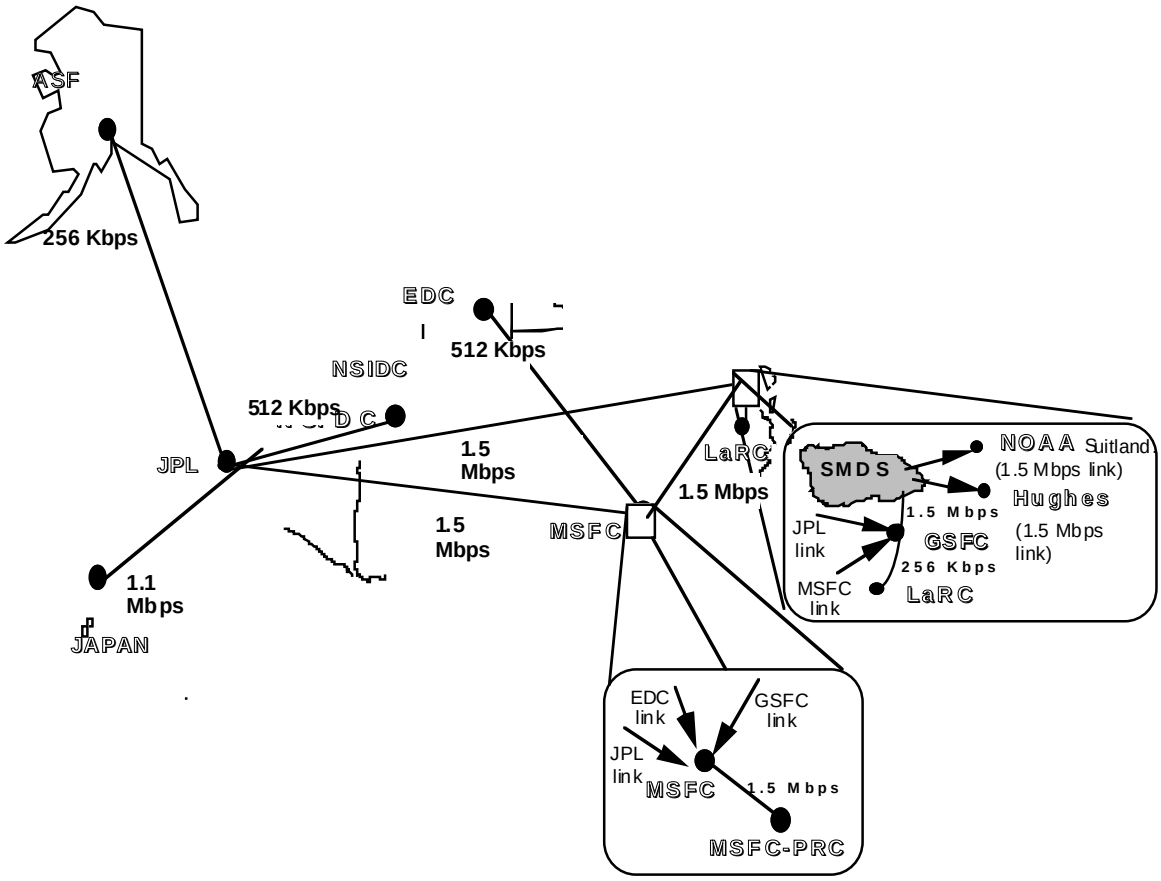

Figure 4-1. The V0 WAN

B. **The ESN WAN.** Unlike the V0 WAN, the ESN WAN is a full-production mission-essential network. As such, the RMA requirements for ESN are higher. In addition to the seven DAACs that the current V0 WAN connects, an eighth DAAC (ORNL), several SCFs and additional ADCs will be connected to the ESN WAN. Table 4-4 lists current V0 WAN link capacities and anticipated link capacities for the ESN WAN during IR1 and RA . Types of data supported during each release are also listed. During Release A, the ESN WAN will carry TRMM data and Landsat 7 interface test data. EOS AM-1

early testing will also begin then. The data traffic is expected to increase significantly during Release B and later since the first of the EOS satellites will be launched in mid 1998.

The external network entities that ESN interfaces with are Ecom, NSI and local/campus networking environments at the DAAC sites. Careful coordination has to be made with these entities to come up with the best setup to satisfy requirements of the parties involved. Such activities have already begun.

C. **WAN Transition Plans.** The ESN WAN during Release A will use V0's WAN infrastructure, including the high-end V0 routers at each site and the PSCN provided circuits that link them. The reuse of this equipment by ESN has three advantages:

- The lead time for circuit requests from PSCN will be reduced, since upgrading existing circuits will require less time than acquiring new ones;
- Gradual ramp-up of ECS network management services, with V0 and ECS teams working in parallel during the transition, will ensure a smooth start for ESN Release A, and a transfer of relevant experience and lessons learned from V0 to ECS.
- Initial use of V0's primary routers, which will be able to support networking activities through RA and possibly into RB, will enable ECS to delay the purchase of some equipment and take advantage of newer COTS technology at a later point.

This does not mean that the V0 Network topology or configuration will not change in order to meet ECS system requirements. Enhancements and changes will be made as required by ECS. There will be sufficient bandwidth to support activities in both the V0 and Release A networks during transition.

The transition process from the V0 WAN to the ESN Release A WAN will begin by sharing network monitoring responsibilities (12/95 time frame) by both V0 and ECS operations personnel. ECS M&O personnel will monitor the ESN WAN out of the EDF (ECS Development Facility) initially. During the 'shared' monitoring phase, V0 will have the primary responsibility for resolving problems and dealing with NSI, PSCN and other relevant network service providers. ECS will shadow these activities and 'get smart' on the causes and resolutions of potential problems and issues. Complete responsibility for managing the network will shift to ECS (see Table 4-6 in Section 4.1.2.3.3 for M&O network operations transition schedule) around 9/96.

Table 4-4. V0 and ECS Release to Link Capacity Mapping

Release	Type of Data (e.g. TRMM)	DAAC-to-DAAC Link Capacity (kbps) **	DAAC-to-SCF Link Capacity (kbps)	DAAC-to-ADC Link Capacity (kbps)
V0 as of 1994	V0 data	ASF - JPL -> 256 EDC - MSFC -> 512 GSFC - LaRC -> 256 GSFC - JPL -> 1544 GSFC- MSFC -> 1544 JPL - MSFC -> 1544 JPL - NSIDC -> 512	N/A	GSFC - NOAA -> 1544
Interim Release 1 (IR1) (December 1995)	V0 data TRMM test data	ASF - JPL -> same as in V0 EDC - MSFC -> same as in V0 GSFC - LaRC -> same as in V0 GSFC - JPL -> same as in V0 GSFC - MSFC->same as in V0 JPL - MSFC -> same as in V0 JPL - NSIDC -> same as in V0	TBD	GSFC - NOAA -> same as in V0
Release A (December 1996)	Landsat 7 test data TRMM data COLOR early test data EOS AM-1 early test data	ASF - JPL -> same as in IR1 EDC- MSFC -> same as in IR1 GSFC- LaRC -> same as in IR1 GSFC - JPL -> TBD GSFC- MSFC -> 10000 JPL - MSFC -> TBD JPL - NSIDC -> same as in IR1	TBD	GSFC - NOAA -> same as in IR1

** The link sizes change as they are upgraded. Connectivity requirements to Japan for TRMM data are still under discussion (JPL or GSFC for International Partner pickup point). Some DAAC-to-DAAC link sizes (during RA) will reflect the outcome of this discussion.

4.1.2.3.2 V0 and ESN DAAC LANs

A. **Current V0 DAAC LAN Architecture.** At the present time, most of the V0 DAAC LANs are simple (a segment or two) and Ethernet based. The method of connectivity between a given DAAC LAN and the respective site network architecture of the LANs can be categorized into two configurations. In the first configuration, the V0 DAAC LAN is connected to the site network via a V0 router (where the V0 router is on the site's isolation LAN). Most of the V0 DAAC LANs have such a setup (see Figure 4-2). In the second configuration, hosts are dual homed (attached to both the site and DAAC networks). Figure 4-3 shows this configuration.

In general, there is low activity on V0's portion of the DAAC LANs, compared to expected activity on ESN LANs . The GSFC and JPL V0 LANs have more activity than the rest of the sites. Table 4-5 shows a listing of the DAACs and their LAN sizes (number of segments) and types.

B. **ESN LAN Architecture.** ESN LANs will be multitiered (high, medium and low throughput ranges) depending on types of the operations that are supported [e.g. high speed (e.g. HIPPI) for the Data Server and Processing subsystems, and medium speed (e.g. FDDI) for the Data Management subsystem]. Most of the current DAAC LANs fit into the low throughput category (10 Mbps Ethernet LANs are used). As a result, the majority of ECS LANs, at least as of release B, will necessarily be new.

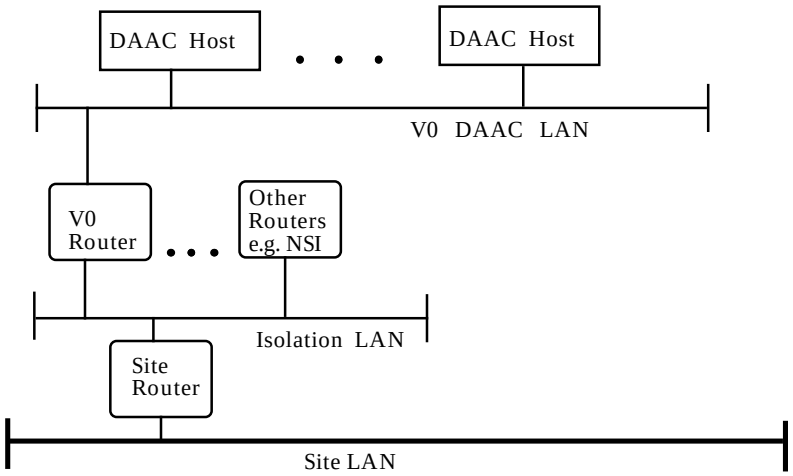

Figure 4-2. V0 DAAC LAN to site LAN connection via a V0 Router

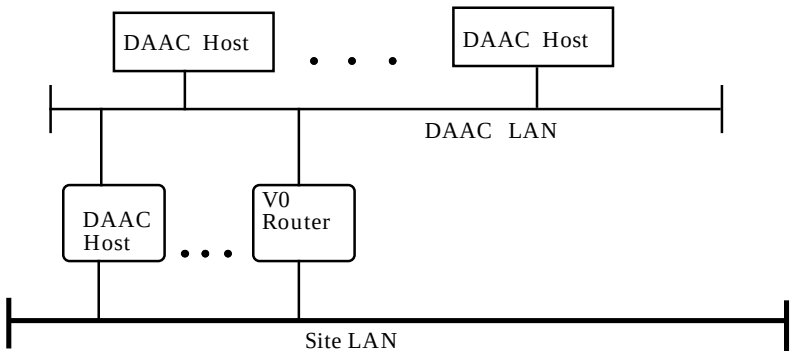

Figure 4-3. V0 DAAC LAN to site LAN connection via a V0 Router

C. **DAAC LAN Reuse Plans.** General information on current LANs at the DAAC sites has been gathered (as an ongoing part of the V0 analysis activity). Table 4-5 shows the types of LANs that exist at each DAAC. A series of DAAC visits were made during 1994 to meet with DAAC and site network personnel and understand unique needs and issues at each site.

During IR-1, existing V0 DAAC LANs at EDC, GSFC, LaRC and MSFC will be used to support tests in the areas of Ingest (except for EDC) and Processing (Algorithm Integration and Test). As such, ECS hosts and peripherals will be positioned on the V0 LANs (total of six to seven network attached devices including printers). Where there is a shortfall in network capacity, ECS will provide the necessary communication equipment necessary to complete IR-1 activities. With the exception of EDC, all of the other DAACs mentioned above will be able to support ECS IR-1 activities. The necessary communication equipment will be installed at EDC to augment the existing V0 network segment.

ECS will deliver DAAC LANs for Release A (which will support TRMM and early testing related to the AM-1 and Landsat misssions). The GSFC, LaRC and MSFC DAACs will have ECS LANs for Release A while activities at EDC will be supported by the same V0 LAN used during IR-1 (an Ingest host will be added for early Landsat data ingest testing). V0 LANs at GSFC, LaRC and MSFC will interface with the ECS delivered network via a router. Interoperability between the ECS delivered networks and V0 LANs will be maintained until the total phase-out of V0. By the time Release B (AM-1 mission support) becomes operational, ECS would have delivered LANs for the remaining DAACs (ASF, JPL, NSIDC and ORNL).

The most recent M&O shedule for DAAC support is listed in Table 4-7. As shown in the table, full support for GSFC, LaRC and MSFC, the three Release A DAACs, will begin in late 1996. This means ESN LAN support will begin at that time for the three DAACs. ESN LANs will be installed at these three sites prior to the DAAC activation time shown in Table 4-7. The rest of the DAACs will have ESN LANs installed a few months before ECS M&O starts full operation at the times given in Table 4-7. There will still be some activity by ECS M&O even before 'full operation' starts at the DAACs.

Table 4-5. V0 DAAC LAN Types and Configurations

DAAC Site	LAN Type	Number of LAN Segments	Network HW (joining devices other than V0 routers) e.g. bridges	Number of high end workstations and Hosts
ASF	Ethernet	1	1 (dual homed host)	1
EDC	Ethernet	1	none	1
GSFC	Ethernet and FDDI	2 ethernet 1 FDDI	2 Hubs	15 - 20
JPL	Ethernet	2 ethernet (segments separated by a MAN)	1 Hub	18
LaRC	Ethernet	1	none	6
MSFC	Ethernet and FDDI	1 Ethernet 1 FDDI	none	15 or more
NSIDC	Ethernet	1	none	3

4.1.2.3.3 Management and Operations

A. **Current V0 Network and Information Systems Management and Operations.** The V0 Engineering Network team and operations group monitors the WAN from 7:00 am to 3:00 am five days a week (with beeper access) using network monitoring software out of GSFC. In addition to the circuits that connect the 7 DAACs, NOAA Suitland (an ADC) and the EDF, some V0 DAAC hosts are also monitored. The ability to monitor the hosts helps in troubleshooting and performance analysis of the network. Some customized code and scripts have been written to do performance analysis and generate monthly reports. Results of trending and performance studies are used for circuit capacity planning.

Configuration management is currently done manually but there are plans to automate this function. Security management is currently done via IP filtering and physical isolation. In addition to performing network related tasks, the V0 team also supports EOSDIS Information Services. These are listed in Table 4-3. See Section 4.1.2.3.4.

B. **ESN Network Management and Operations.** Network Management activities for ESN will begin in December 1995 at the EDF facility. It will start out by 'shadow' monitoring the V0 WAN. During this period, the V0 Network team will have primary responsibility for monitoring, troubleshooting and interacting with network service providers such as NSI and PSCN. ECS M&O will closely watch V0 Network team activities to learn and gain V0 experience. In September 1996 ECS will take over responsibility for running the WAN (at this time it will be the ESN WAN). The ECS NMF (Network Management Facility) activities will include:

- o network fault management
- o network security management
- o network performance management
- o network configuration management

The V0 Network team, will now 'shadow' ESN network activities for a short period to give guidance as needed. As each DAAC gets M&O support, ESN LANs will be operated by on site staff. The current M&O schedule for DAAC activation's is listed in Table 4-6. The ECS DAAC LAN staff will coordinate as needed with the ECS NMF for troubleshooting and problem resolution. M&O NMF and DAAC activities will start out with an 8X5 type operating schedule and will gradually go to 24X7 in later releases of ECS. Table 4-6 shows the responsibilities of the V0 Network Team and ECS M&O during the phased transition.

Table 4-6. V0 Network Tean and ECS M&O Activities Table During V0 Network Transition(Page 1 of 2)

Time Frame	V0 NOC Team Responsibilities	ECS Responsibilities
12/95 - 9/96 (3 months before RRR for RA)	- V0 WAN Management (fault, performance, security and configuration) - Interaction with PSCN (for troubleshooting and circuit upgrade requests) - Interaction with NSI and other network service (Internet) providers - Interaction with V0 DAAC LAN staff - Support of V0 Information Services	- 'Shadow' monitor the V0 WAN using network management system of choice (from EDF). Read access to V0 network equipment will be allowed. - Perform necessary upgrades to V0 network equipment and circuits in order to meet ESN Release A requirements. - Learn from V0 staff activities especially the interaction that takes place between V0, PSCN, NSI and other network service providers in resolving network problems
9/96 - 12/96 (RRR for RA)	- 'Shadow' monitor the V0 WAN using network management system of V0's choice with a read access to ESN network equipment. The V0 team will give advice as needed. - prototyping activities	- V0 WAN Management (fault, performance, security and configuration) - Interaction with PSCN (for troubleshooting and circuit upgrade requests) - Interaction with NSI and other network service (Internet) providers - Interaction with V0 DAAC LAN staff - Since the GSFC, LaRC and MSFC DAACs will be activated at this time, ECS hosts at these sites will also be monitored from the NMF and there will be M&O staff on site to support ECS LAN activities.

Table 4-6. V0 Network Team and ECS M&O Activities During V0 Network Transition (Page 2 of 2)

Time Frame	V0 NOC Team Responsibilities	ECS Responsibilities
12/96 and later	- Transition process completed	- V0 WAN Management (fault, performance, security and configuration) - Interaction with PSCN (for troubleshooting and circuit upgrade requests) - Interaction with NSI and other network service (Internet) providers - Interaction with V0 DAAC LAN staff - The rest of the DAACs will be activated (EDC , NSIDC , ASF, ORNL and JPL in 1997). As these DAACs get full M&O support, ECS LANs will be connected to the ESN WAN.

C. **M&0 Activity Schedule**

Table 4-7. M&O Schedule for Network Management Support Table

M&O Activity	Time/Release
Shadow monitoring of the V0 WAN out of EDF begins	12/95
ECS M&O takes primary responsibility for monitoring ESN WAN	3 months before RA RRR
ECS M&O takes full responsibility for monitoring ESN WAN	RA RRR
Support for LaRC, MSFC and GSFC DAACs	2 months before RA RRR
Support for NSIDC, EDC, ASF, ORNL and JPL DAAC LANS	2 months before RB RRR

4.1.2.3.4 V0 Information Services

A. **Current Services.** The V0 Network team currently provides a number of services that are collectively known as V0 Information services. The services are Anonymous FTP, X.500 Directory Service, Listserv, E-mail Forwarding, Bulletin Board, Gopher and

WWW. These services are summarized in Table 4-3. Additional services may be added between now and the IR1 time frame.

B. **Transition of Services to ECS.** Of the current information services provided by the V0 team, the ones to be incorporated in ECS are the X.500 directory, anonymous FTP, bulletin board, and e-mail related services. These services map into CSMS requirements. There are no CSMS requirements to provide WWW, WAIS or Gopher services. However, if SDPS uses WWW, WAIS or Gopher to fulfill a given requirement (e.g. Guide services), CSMS will provide the necessary communication support services. Any new information service that the V0 team may provide between now and RA will be considered for transition to ECS on a case by case basis.

   The proper time for beginning the transition process for the relevant information services would be three months before the RRR for RA (9/96). During the few months before RA, CSMS directory and e-mail related services will have been set-up on ECS systems and will be positioned to take over the responsibility of providing the services by RA RRR (12/96). After 12/96 ECS M&O staff will have full responsibility for running the services including user support.

   The ECS bulletin board service (which has a Release A version) may take over V0's Usenet services. An ECS Anonymous FTP service should also be set up and be positioned to provide similar services as the V0 Anonymous FTP by 12/96.

4.1.3 User Services

The EOSDIS User Services Working Group (USWG) was formed in 1991 to address problems of common concern and to begin working towards a Version 0 system in which centers have a unified approach and appearance to the outside world (users). The USWG consists of representatives from the User Services offices at each of the eight EOSDIS DAACs (including ORNL), the four NOAA ADCs and SEDAC.

The USWG has an organizational structure enabling it to function effectively: a Chairperson, Co-Chair, and an Executive Committee. The USWG and its Executive Committee each conduct monthly telecons and hold semi-annual meetings to discuss and resolve issues of concern to the Centers. They maintain and work through an action task list supporting the transition to V0, maintain a timeline of milestones that are necessary for the transition and have produced an extremely well prepared Handbook for its members.

The USWG has a stated goal "to provide coordinated, consistent and improved access to existing Earth science and global change data sets for the scientific community. As the first line of contact, the individual (User Services) personnel at the data centers play a critical role in user acceptance of these activities and must be well versed in the varied data holdings across the centers."

The USWG has established a charter, incorporating a series of responsibilities. They actively support users in many ways, including training on the evolving system, accessing data and working with the instrument teams to make preparations for the acquisition and archiving of new data sets.

The V0 USWG is a well established organization, staffed with professionals who are dedicated to work together to evolve the best possible system for their users. It is imperative that ECS build upon the infrastructure the USWG has established.

4.1.3.1 Lessons Learned

The USWG is an outstanding example of coordinating similar functions across disparate organizations (DAACs, ADCs, SEDAC, NASA, USGS, DoE, universities, consortiums, NOAA, etc.). These groups have come together with a common goal and charter to share ideas, experiences, problems etc. for the betterment of the entire operation. Since it is not yet completely clear what the ECS role and responsibility in the User Services arena will be, we must be prepared to eventually play a key role in this structure for V1 and beyond. At the minimum ECS should play an active role wherever we do have User Services responsibilities. Our evolving role is an issue to be tracked.

Another lesson learned is the level of participation of the USWG at each DAAC with their UWG, the users evaluation of the evolving V0 system (i.e., the tirekickers), and their involvement with field expeditions in gathering information for the development and science support groups to plan for the acquisition and archiving of new data sets into the DAACs. This high degree of interaction with the users ensures that the USWG can identify and react to problems and trends.

A recent lesson learned is the amount of time required to support the USWG. The Chair and Co-chair positions are each .5 FTE, funded by ESDIS. They are currently averaging 120 hrs/mo on these functions. Executive Committee members are averaging 55 hrs/mo vs. the 18 originally budgeted/projected. These workloads bear tracking, again, depending on what role we do play.

One of five splinter groups formed is the V0 - V1 transition group. At last October’s workshop at CIESIN, we were unified attempting to address the generic issues involved in the transition rather than the vested interests each contractor / government employee has. We'll track how well we can maintain our unity as the V1 User Services roles begin to solidify.

Finally, a periodic revisions to the Handbook are necessary (they just issued their first revision.). Certainly we will either have to issue our own ECS User Services Working Group Handbook or have major input to another revision of the Handbook as V1 is activated at the DAACs (perhaps not until Release A or maybe even Release B).

4.1.4 NCSA Tool Support

Currently, two of the NCSA tools have been identified for potential reuse: the HDF libraries and Mosaic. In support of this effort, the PGS toolkit development staff has been expanded to include a former NCSA software developer with expertise in these tools.

The HDF libraries will be used in the PGS toolkit. NCSA currently receives funding from NASA ESDIS for HDF software development, but the level of funding is insufficient to meet ECS needs. We anticipate that ECS will be the major customer of HDF for awhile, and therefore the major driver for their software development. Therefore, we are in the process of submitting a proposal to supply additional funding to NCSA to re-engineer and document the HDF software.

Mosaic is a tool for accessing data in World-Wide Web (WWW) servers as well as other Internet tools such as Wide Area Information Servers (WAIS), Gopher servers, Archie servers, etc. Mosaic supports hypertext using the WWW language called HTML. It can display test as well as graphics in formats such as GIF and HDF. V0 is using WWW and WAIS for their guide implementation. ECS is also prototyping with these tools in EP3 and EP4. The ECS Data Handling System (EDHS) will be using Mosaic, WWW, and WAIS to give the science community access to ECS information such as CDRLs, white papers, RIDs, etc.

4.1.5 Data Dictionary

The V0 data dictionary work has been used by the ECS information modeling team to understand the metadata implementation and contents of each DAAC. This information has been used to help create the core metadata and to classify dataset specific metadata by data type. For example, it is useful for defining attributes of image data types as well as dataset specific attributes of AVHRR data.

The V0 data dictionary effort that was described in the previous draft of this report has been terminated. It was determined that the best experience can be obtained by ECS through employing people from the V0 ESDIS IMS team. The personnel worked part-time to help define the data dictionary services required and the possible pitfalls in the current view of these services in the SDPS architecture. Instead of primarily obtaining documentation from the DAACs, ECS will be gaining personal experience and the contacts of the ESDIS IMS team.

The V0 data dictionary will be upgraded to be semi-automated in future releases of the ESDIS IMS client. See the detailed cell on Data Dictionary for further explanation. The future enhancement will be in providing software located with the client that will check a central location for obtaining updates to the dependent valids stored with the client. The updates will be downloaded via ftp and used there until the next update is made to the ftp site.

4.1.6 Human-Machine Interface (HMI)

Detailed analysis of Version 0 user interfaces revealed integration potential in three areas: HMI standards, HMI development processes, and user interface functions. The V0 HMI analysis included a review of HMI standards published in the LaRC and ESDIS Project Group Lessons Learned documents, and an on-line analysis of the V0 user interfaces. The standards and development processes recommended for integration are described in Section 4.1.6.1. Additional HMI standards recommended for ECS development can be found in the User Interface Style Guide White Paper. User interface functions likely to be integrated are described in Section 4.1.6.2.

4.1.6.1 V0 HMI Standards and Development Processes

All V0 systems having a unique IMS were analyzed in an on-line, interactive fashion. Those systems are:

- LaRC GUI and ChUI
- ESDIS IMS GUI

- EDC ChUI
- CIESIN ChUI
- ASF ChUI

Lessons Learned documents were reviewed for information about V0 HMI design guidelines and philosophies. The results of the on-line analysis indicate that the V0 graphical user interfaces were developed in accord with basic human factors principles. The V0 designers incorporated Motif widgets and multiple windows. The use of standard widgets and window controls provided immediate familiarity with control operations for previous Motif users. The organization of functions within the windows was consistent and the number of functions were kept to a minimum. Both of these factors helped to insure simplicity and ease of use.

The HMI standards and development processes which have high integration potential are:

- **Application of user feedback.** The LaRC development team adopted the philosophy of rapid prototyping and frequent user feedback. The IMS was released in phases, and user representatives were asked to evaluate the new features in each release. Each revision contained improvements and corrections based on user feedback. This provided users the opportunity to view the tangible results of their feedback. Each user who provided feedback also received a written response from the development team. The LaRC IMS has a high level of user acceptance, in part because user inputs were handled effectively.
- **User familiarity.** The V0 user interfaces all use terms which are familiar to scientific user representatives. These systems are designed and organized to allow the users to effectively perform their tasks. User working group activities have allowed developers to become very familiar with the representative user.
- **Minimal use of color.** In general, color was used sparsely and did not distract the user. LaRC effectively limited their number of colors per window to five and the total number of colors for the system to seven. Both the LaRC and ESDIS IMS user interfaces used color consistently and effectively to group related functions and to provide cues to the user.
- **Application of standard conventions.** The standard Motif style of widget presentation and interaction was employed in the LaRC and ESDIS IMS.
- **Timely user feedback.** The V0 systems provide timely and descriptive user feedback in most areas. The ESDIS IMS provides the capability to cancel time intensive operations such as loading the interface or conducting a search.
- **Error prevention.** Overall, errors were prevented by gray-shading items that were not currently accessible. Available keyboard commands and functions were continually displayed in the character user interfaces. Lists containing only valid choices, and prompts describing proper text field entry formats also reduced errors and operator memorization load.
- **Consistency.** Terms and controls were used consistently in the ESDIS IMS. Consistent window organization helped to simplify the use of these systems. Color coding was also consistent in the V0 systems.

- **Use of Abbreviations.** Minimal use of abbreviations in the V0 systems made terms and selections easy to understand.

4.1.6.2 V0 User Interface Functions

The V0 HMI functions with integration potential are described in Table 4-8. More detail may be found in the Detailed Cells.

Table 4-8. HMI Component Integration Summary (1 of 2)

Candidate Function	Preliminary Assessment
Hardware	
none identified	
Software	
none identified	
Design	
Display Results HMI	Method of displaying search results based on the EDC, LaRC, and ESDIS IMS has a . reuse potential.Some additions will be necessary.
Distribute Status HMI	LaRC method of displaying distribution status has reuse potential.
Dumb Terminal HMI	CIESIN and LaRC ChUI concepts have a high potential for reuse.
Guide Search HMI	Concepts from both the ESDIS IMS and the LaRC hypertext interaction scheme have reuse potential.
Inventory Search HMI	Basic query construction concepts from the ESDIS IMS and LaRC have high reuse potential. Additions will be necessary to meet V1 requirements.
Order History HMI	LaRC and ESDIS IMS methods of displaying order status has potential for being integrated.

Table 4-8. HMI Component Integration Summary (2 of 2)

Candidate Function	Preliminary Assessment
Product Requests HMI	LaRC method of creating one-time orders has reuse potential.
User Comments HMI	ESDIS IMS and LaRC methods of entering free text comments should be integrated in combination with more objective feedback tools.
User Registration HMI	LaRC log-in portion of user registration has a high reuse potential.
Experience	
Lessons Learned	LaRC lessons learned for collecting user feedback has high potential for integration into ECS user data collection process.
Process	
User Working Group	LaRC User Working Group process, especially collection of user feedback and method of response, will be integrated into ECS user data collection process.

4.2 IMS

This section provides updates to the analysis previously provided in the SDR release of the Version 0 Analysis Report. Section 4.2.1.1 focuses on Version 0 experience integrationthru informal meetings and integrating of V0 personnel into the ECS team. Section 4.2.1.2 identifies Version 0 software integration into ECS. Some of the information presented here includes all of Version 0, not just the IMS. Most of the Version 0 comments are related to the IMS and were therefore determined to be most relevant to this section.

4.2.1 Version 0 Experience Integration

The principal source of V0 reuse has been not in the specific components, but in the knowledge and experience of the people involved with the V0 system. This reuse of experience includes not only the V0 developers, but the V0 scientific user community. A number of vehicles have maintained a flow of information between the individuals involved with VO and the V1 developers. The mechanisms for integrating experience are presented in the following sections

4.2.1.1 Informal Meetings

Informal meetings such as workshops and telecons provide a forum for exchange of ideas and analysis of ECS design. Version 0 developers have had direct influence on the SDPS architecture, the requirements, the data architecture, and operations concepts thru the following:

- Design Working Group Telecons. The telecons provide for a periodic forum for the exchange of ideas on topics in specific areas of the ECS design. Participants include ECS developers, the VO DAACs, and the science advisors. Telecon topics in areas of design specific to IMS have consisted of implementation of dependent valids, homogeneous data collections and user defined terms in the data dictionary. The Design Working Group

telecons provided a means for IMS developers to present their design ideas and obtain rapid feedback.

- The L4 Requirements Workshop. This workshop was held in December 1994 to provide for the review of the initial draft of the ECS level 4 requirements. VO DAACs and the V0 system developers were represented at the workshop, as well as members of the science community. IMS was assigned approximately 40 action items from the workshop relating to the IMS Level 4 requirements.
- The UVA/SWA Tirekicking Workshop. The workshop objective was to provide "real time" feedback on Version 0 functionality, useability, problems, and suggestions to both ECS and Version 0 developers. Major IMS lessons learned from the workshop were:
  - Provide consistent results for searches. This encourages confidence in the system data
  - Use aids to inform users what to do and how to do it. This promotes user friendliness in the interface. Tirekickers noted that it was east to get lost in the screens.
  - Provide consistent terms between the screens.
  - Provide exact valids information directly on the screen or inform user that lists are available to be used.
  - Provide an data order capability directly from the directory screen.
  - Provide visibility of keywords for guide and directory searches.
  - Provide undo buttons
  - Provide an online users manual
  - Status ongoing operations
  - Provide a summary of number of granules returned from a search
- IMS bi-weekly meetings with the ESDIS IMS from NASA Goddard. The meetings provide for the periodic exchange of status information between the IMS V1 development leads and the ESDIS IMS development leads. Although agendas are prepared, the meetings are informal, and provide for an open exchange of information without any restrictions on topics. Follow-on meetings are scheduled on specific topics on an as-heeded basis.

4.2.1.2 Version 0 Personnel Personnel integrated with ECS

IMS has brought into the V1 development team two individuals with considerable V0 and V0 related development experience. one brings expertise from both ECS Version 0 and TSDIS (Tropical Rainfall Monitoring Mission Science Data Information System) prototype development work. His V0 work included performing technology trade studies for the EOSDIS V0 IMS project. This included writing a detailed survey of user interface technology. In addition, he undertook a detailed survey of public domain image display products for V0. Related NASA experience which is being applied to the ECS V1 effort includes analysis, design, and implementation of the TSDIS Browse Display System user interface, which included X-windows

and Motif programming to generate a portable, user friendly interface. This provided invaluable experience interacting with the science community, then obtaining and incorporating relevant feedback into the user interface design. Further, interacting with the production generation staff lead to an understanding of the issues germane to processing the TRMM data and creating an efficient user interface to access it. He is presently the team leader for design and development of the V1 Client Subsystem.

The team leader for design of the V1 Data Management Subsystem, worked on both the design and implementation of the user interface and database portions of the Goddard IMS. His user interface experience includes developing IMS client screens, use of valids in the client, results display, product order, and document search. His database experience includes work on the interface software to the Goddard DAAC server database for the metadata base. The software supported document and product searches, user help, product requests and request statusing, dependent valids, and tracking of product requests. He also wrote for the Goddard DAAC IMS a subset of an FTP client integrated with rest of the client software. This permitted a user to use FTP without invoking a separate interface, and is expected to be similar to the implementation used by V1.

As part of the recent decision to reuse/enhance the V0 ESDIS Client for the Release A ECS Client, Hughes STX VO ESDIS Client developers will be assigned to directly work with the ECS IMS development team. The integrated client development team will focus on incremental improvements in the V0 Client software to support access to the Release A V1 components. Upgrades for V0 will be determined by impact on V1 schedules and technical merits. Some specific areas being examined include V0 client support for the V1 visualization toolkit (EOSVIEW), and VO client upgrade to support V1 data dictionary functionality. All V0 client upgrades will be for Release A delivery only. Full V1 functionality will be introduced with Release B delivery of the V1 client.

4.2.1.3 Software Integration

Version 0 Gateway. IMS has recently created a new CSCI (Computer Software Configuration Item) for which there is a high probability of reuse of VO code. The CSCI, which is named the Gateway, is in the Data Management subsystem, and will serve as the interoperability interface to VO and NOAA. The Gateway design calls for it to emulate the ESDIS VO Client and an ESDIS VO DAAC in order to achieve a high level of transparency to the VO system. It is expected that a high degree of V0 code reuse will be realized in the implementation of the Gateway VO emulation. An analysis of required Gateway functionality is underway, and VO code will be examined for identification components reusable for the Gateway CSCI. Since the Gateway CSCI was approved by the SDPS CCB only in early January, formal work on it is just beginning. Informal estimates of reuse at this time are approximately 60%-70% of the IMS server code will be reused. This consists of two complete server layers and a portion of a third layer. It is expected that the message building and network layers will be heavily reused. Portions of the format translation layer will also be reused. It is not expected that the data base interface layer will be reused.

Evaluation of V0 mapping software. In a collaborative effort between ECS and the University of Maryland, a process experiment is being performed that seeks to match existing software

assets in class libraries with desired capabilities. This process has been partially enacted in an experiment in choosing software to fulfill the Map function of the SDPS Client Subsystem. The intent is to reduce custom software development with attendant cost, schedule, and quality advantages. The purpose of the experiment is to quantify both effort avoidance and potential side effects such as integration complications. An off-the-shelf package has been provisionally selected from a group of four candidates that included the V0 map function. The early stages of this experiment have yielded findings on selection criteria, estimated effort avoidance, and counter-balancing required evaluation effort. The experiment shows promising results and will proceed into the detailed design phase of ECS. The intent is to eventually solidify a systematic process on the difficult cognitive problem of matching available software to desired capabilities. The results of the analysis are presented in Table 4-9.

Table 4-9. Object Reuse Evaluation Results

Functional Criteria	UIT	V0	Vendor X	Vendor Y
Zoom-in	Yes	Yes	Yes	Yes
Pan	Yes	Yes	Yes	Yes
Adequate Resolution	Yes [1]	No	Yes	Yes
Political Boundaries	Yes	Yes	Yes	Yes
Terrain features	No	Yes	Yes	Yes
Lat/Lon lines and labels	Yes	Yes	Yes	Yes
Various Projection Options	Yes	Yes	Yes	Yes
Polygon Drawing	Yes	Yes[2]	Yes	Yes[2]
Display spacecraft foot tracks	Yes	No	Yes	Yes
Display ground stations	Yes	No	Yes	Yes
Display bathymetry data	Yes	No	No	No
Region highlighting	No	No	Yes	No
Select Granules	Yes	No	No	No
Access to services available for granules	Yes	No	No	No
Source Code Available	Yes	Yes	No	No
Cost	Free	Free	?	10-12K
[1] WDB-2				
[2] No general polygons				
Quality Criteria				
Non-functional Application Characteristics			n/a	n/a
Reliability			n/a	n/a
Usability			n/a	n/a
Maintainability			n/a	n/a
Efficiency			n/a	n/a
Portability			n/a	n/a

4.3 Data Server (DADS)

Since the beginning of the ECS contract, DADS (now data server) personnel have been in communication with Version 0 personnel. ECS personnel have worked to understand and learn from V0 experiences to date in the areas of system development, user access loads, and earth science data specific problems. Prior to SDR a number of site visits, teleconferences and E-mail messages were exchanged to better understand the lessons learned at each DAAC. After PDR several meetings and occasional E-mail messages reinforced Version 0 lessons learned. Data server personnel participated in the review of the GSFC DAAC's Backup Design. LaRC DAAC personnel visited the ECS facility in Landover to participate in vendor presentations, share technical problems and discuss solution strategies and options. ASF personnel also visited Landover to discuss their requirements, share system information and obtain copies of ECS technical papers. Data server personnel also maintained an interface with the ECS Systems Engineering Site Liaisons who provided a window into the daily operations at each of the DAACs.

Aspects of Version 0, such as the IMS client, which ECS will incorporate into Release A as described elsewhere in section 5. Other aspects, such as the archive systems, would be more difficult to integrate for the reasons explained below. The SDR version of this document describes in Section 4.3.1.2.1.3 the role that the File Storage Management System (FSMS) plays in the archive, and how knowledge of the workings of this component is critical to the entire archive system. The Version 0 archives fall into three broad categories:

- SunCoast-based Systems (2 Sites)
- UniTree-based Systems (3 Sites)
- Custom/Manual Systems (2 Sites)

SunCoast-based Systems (MSFC, NSIDC) These systems essentially separate volume and file serving requirements in a manner similar to the data server architecture. The SunCoast product acts as a volume server which manages a Write Once File System and the associated device drivers for WORM type devices and a limited number of tape devices. The file server consists of a relational database "Front-End" that holds metadata and pointers to the associated file data.

This is a sound design but the product is primarily limited to lower capacity devices. In addition it is unclear that the product will handle data rate and other functional and performance requirements imposed by ECS, or that it will scale to handle the required capacity.

UniTree-based Systems (GSFC, JPL, LaRC) UniTree represents one of the few archive products which was available when several of the Version 0 prototype projects began. Though two different versions of UniTree are in use, DAAC personnel report many of the same problems. These include: (1) poor or non-existent network file system (NFS) performance, (2) limited archive management and performance monitoring capabilities, (3) proprietary data storage formats, (4) poor or inconsistent general logging and error logging, and (5) limited or non-existent concurrent read/write operations.

UniTree also suffers from the lack of a consistent baseline across fielded products, as described in the SDR version. The acquisition of Discos by Open Vision has not provided any impetus for standardization, and product capabilities vary widely between vendors and host platforms.

Custom/Manual Systems (ASF, EDC) These systems may utilize existing File Storage Management Systems for a portion of their internal working but custom code provides the majority of the functionality. In addition, these sites primarily rely on manpower intensive "lookup, fetch, and load" operations to find the requisite media volumes for processing. This type of system is unacceptable for Version 1 use from an operational perspective given the projected number of archive queries and retrieval requests expected under Version 1 operations.

Discussions with DAAC technical personnel prior and subsequent to SDR have given data server personnel a more complete understanding of the implications associated with the envelopment or integration of the DAAC archive components, as discussed in Section 4.3.1. The description of V0 as a prototype with operational elements has been shown to be very accurate and appropriate. These systems were constructed with the best equipment available at their inception, but much of this equipment does not meet the current reliability, maintainability, and availability (RMA), bit error rate (BER), and capacity requirements of ECS. Version 0 systems provided a basis from which many of the ECS requirements were drawn. These include: BER and performance monitoring, archive and volume viability testing, degraded mode operations capabilities, scaleability, and evolvability. These systems were not designed to meet the data loads and storage capacities required by ECS. Rather they provided the foundation for the ECS requirements and design that is reflected in the current ECS Element and Segment Design Specification documentation.

4.3.1 V0 Archive Envelopment Study Update

This section of the Version 0 Analysis Report updates the V0 archive envelopment study that was initiated prior to the ECS SDR. There were several goals driving the SDR version of the analysis. The principal goal was to determine to what extent existing V0 archives could be enveloped into the ECS architecture with minimal disruption to existing V0 operations and in a manner that would be cost-effective to the ESDIS Project. Envelopment is assumed to mean that the component becomes part of ECS; ECS is responsible for ensuring the operability and maintainability of the component according to ECS requirements. [For complete definitions see section 3] Additionally, this analysis assisted the SDPS design effort through an investigation of potential DAAC V0 hardware, software, design, experience, and processes to be reused or built upon as the design effort progressed. The content of the SDR version of the analysis was, however, constrained by several factors. The SDPS architecture concepts were still evolving as the envelopment analysis was being performed, so it was not possible to ascertain exactly how candidate components could be enveloped into SDPS elements. Additionally, Level 3 requirements were still evolving, and the Level 4 requirements and complementary subsystem design efforts had not yet begun. These factors directed the focus of the SDR envelopment analysis away from integration of components into the ECS design and towards a more complete understanding of the DAAC V0 architectures, components, and design rationale. This analysis was completed at SDR for those DAACs required to support ECS Release A. It included a

discussion of the components at each of the DAACs and potential issues associated with the envelopment of those components based on the SDPS architecture concepts at the time.

A complete analysis of GSFC, LaRC, and MSFC archives can be found in the SDR version of this Version 0 Analysis Report. That version documents: the archive architecture, the growth projections, the envelopment issues, the technical issues, the system-level issues, the hardware issues, the software issues, and the data issues

The conclusion of the SDR analysis was that no DAAC V0 components could be recommended for envelopment based on issues identified and documented in the analysis. The identified issues included system-level, hardware, software, data, requirements, logistical, and other issues that would need to be resolved in order for DAAC V0 archive components to be enveloped. It was determined, however, that the possibility of envelopment would remain open until PDR-level SDPS design efforts were completed. The PDR update to the envelopment analysis focuses on how the identified issues would affect the envelopment of components in light of the progress that has been made in the definition of more detailed SDPS requirements and design concepts. This analysis makes use of the knowledge of the DAAC V0 requirements, architectures, and components gained during and subsequent to the SDR analysis and applies it to the current SDPS data server requirements and design. The conclusions of the PDR analysis support those of the SDR analysis, in that no DAAC V0 archive components can be recommended for envelopment into the data server. The migration of data sets from Version 0 to Version 1 remains an approach that is both more cost-effective and one which promotes consistency in meeting ECS functional and performance requirements for all Version 1 data sets. The following sections discuss the implications of envelopment on the data server design that was developed and is documented in the PDR SDPS Segment Design Specification. The analysis follows with a discussion of critical SDPS requirements and design goals and the challenges associated with meeting these requirements with enveloped components. Finally, the analysis concludes with recommendations for other possible mechanisms that would allow access by ECS users to data contained within heritage archive systems without the ramifications associated with envelopment.

4.3.1.1 PDR Envelopment Analysis Process

The PDR envelopment analysis took advantage of SDPS and data server subsystem requirements and design information that were not available at SDR. Level 4 requirements for the data server subsystem were analyzed along with data server trade studies and the element design specification being developed for PDR in order to gain a thorough knowledge of the design with which enveloped components would potentially be integrated. Combined with this was an analysis of the implications of envelopment on both the data server subsystem and the enveloped components in terms of compliance with requirements, maintenance and operations, and evolvability considerations. The results of this analysis are presented in terms of the implications of envelopment on ECS requirements and design goals.

4.3.1.2 Envelopment Implications

As a preface to discussing how archive components could be enveloped it is important to identify and understand the implications of what it means for the ECS to envelop a component or group of components. Enveloped components must be logically and physically separated from the

heritage system from which they originated and must become an integral part of the ECS operational system. Furthermore, since the enveloped components become an integral part of the ECS, they must meet all ECS functional and performance requirements, and are subject to the same evolvability goals as other ECS components. Finally, ECS would be responsible for the operation and maintenance of all enveloped components. Consideration had been given prior to SDR concerning the relaxation of ECS requirements for enveloped components. The relaxation of certain requirements, especially those related to performance, could be accommodated without major impact to system operations. Certain basic functional requirements, however, could not be relaxed without significant impact to system development, operations, and data integrity. The following sections discuss the ECS requirements that are not met by enveloped components. They are divided into those items which are deemed to be critical to the ECS design, and those which are not critical, but raise significant developmental or operational issues.

4.3.1.3 Critical Envelopment Issues

ECS Level 4 requirements that have been allocated to the data server subsystem are broken down into several types including functional, performance, security, standards, and others. The requirements related to the envelopment of components that are deemed to be critical are basic functional requirements related to maintaining data integrity within the archive. A series of requirements have been levied on the archive components that are related to the monitoring of archive system parameters related to archive media degradation. These requirements are designed to ensure that data integrity is maintained within the data server. This requirement is implemented through bit error rate (BER) monitoring capabilities provided by the archive file storage management system (FSMS). The FSMS will periodically read portions of all media contained within the archive, and will calculate, maintain, and report BER statistics that track the eventual degradation of the archive media. When the reported BER reached a predetermined threshold the archive system copies the data contained on the degrading media to fresh media before any loss of data occurs. Maintaining the integrity of the data contained within the data server is one of the most important goals of the ECS, and is one which is difficult to assure with enveloped components. The gathering of BER statistics required to support the media refresh process is currently supported by very few FSMS products, none of which are currently in use in the DAAC V0 archives. If the integrity of the V0 data is not to be put at risk, it would involve the transfer of V0 data out of its current FSMS structure and into one which supports automatic BER monitoring. The effort required to perform this transfer is a major step in the data migration process, and the subsequent insertion of the newly structured data and supporting FSMS back into the heritage components would require additional integration effort and offer none of the advantages associated with completing the data migration process.

Several other requirements are placed on the ECS data server archives that collectively are not supported by the current V0 archive components. One is a requirement that the data server use openly published and non-proprietary data formats to archive data. Several of the storage management products in use in V0 use vendor-proprietary formats. The implication of this is that ECS is not able to alter or tailor the operation of the FSMS to a particular application without vendor involvement. The use of proprietary file storage formats also often limits control in how data is physically stored on the archive media. The use of non-proprietary archive formats allows easier tailoring of archive storage parameters, and is one mechanism that will be used to

increase archive system performance and flexibility. A related pair of requirements is that the archive shall use a fully described file structure and physical file organization on the volume containing the archived data. This is especially important in later ECS releases as the archive functions and components become more distributed. The monolithic archive system approach supported by many of the V0 components does not support these file structure and organization requirements. Another design item that is critical to successful data server operation is the use of standard applications programming interfaces (APIs) in support of all data storage and retrieval requests. The requests for proposal (RFPs) that ECS has released to FSMS vendors includes a requirement that the vendor provide a standard set of APIs for communication with other archive system elements. This is critical to the ability to add, delete, or otherwise modify select archive components without disrupting other data server or SDPS elements. Finally, the FSMS products under consideration for ECS must also support the mechanisms that simplify performing content based searching within the archive (e.g., providing access to archive data at granularities smaller than the file level). Not all of the requirements or functions mentioned above are currently supported by any of the V0 archive components.

The envelopment of archive components which do not support the requirements listed above would impact the data server and SDPS in several ways. The foremost concern is that of maintaining integrity of all data contained in the Version 1 archives. Second would be the cost and schedule risk associated with the internal development and maintenance of the APIs and other software required to integrate the heritage components. Third would be the impact on the performance of the data server archive components when any query or retrieval request would need to access data stored on the enveloped components. This stems both from basic differences in supported metadata between V0 and V1 systems, as well as other differences in supported level of service. Associated with this is the concern that certain standard ECS services (such as content based search) would not be supported for the data contained within the enveloped archive.

Other key envelopment issues identified in the SDR version of this analysis (e.g., the implication of testing and integrating an operational V0 archive component into V1) still present serious concerns in addition to the concerns described above. It is for these reasons that envelopment is not recommended as a viable or cost-effective alternative to the migration of V0 data to V1. Methods other than envelopment for connecting heritage archives to Version 1 are integral to the ECS design and are presented below.

4.3.1.4 Envelopment Alternatives

In the event that data contained within a particular Version 0 archive or any other heritage system is deemed to be too costly or not in high enough demand to justify the cost of data migration, there are several options for how this data could be made accessible through Version 1. The first alternative data transfer mechanism for Version 0 archive data is through the V0 to V1 interoperability that is being provided through the ECS data management subsystem. This interface provides a translation between the V0 ODL and ECS query language for the transfer of archive queries and data retrieval requests. This interface is being developed and maintained as part of the ECS contract in support of the transition between Version 0 and Version 1 operations. This is not, however, a permanent mechanism for accessing data outside of the ECS archives

since the V0 system IMS will cease to be supported at some point. Therefore, an alternate mechanism is provided within the ECS architecture which allows the connection of archives outside of the ECS sphere of control.

The ECS architecture does have a effective method for Version 0 integration built into its design. This involves wrapping an interface layer around Version 0 systems via the use of the ECS Services API toolkit. Each Version 0 system would then become another data server at its associated DAAC site. Using the appropriate ECS API & toolkit documents and Interface Control Documents (ICDs) for this work, Version 0 personnel, who are intimately familiar with their system, could develop the necessary interface modifications using their design documents, Unit Development Folders (UDF), and ICDs. This approach would result in some performance and administrative penalties as well as Level of Service differences between Version 0 and Version 1 data sets, but this approach would allow Version 0 systems to be tied into the ECS system. The ECS architecture also provides for data migration between data servers. As the Version 0 data and storage technologies continue to age, the same ECS Services API could be used in the migration process to move this data to other data servers and storage devices.

4.4 Product Generation System (PGS)

The product generation is not a major focus within Version 0. Because of this, the scope of this study was expanded from V0 to include looking at other PGS related efforts happening at the DAACs, or related facilities. Some analysis was performed on the use of automatic scheduling.

In the area of automatic scheduling, ECS looked at the Sea-Viewing Wide Field Sensor (SeaWiFS) scheduler, the Goddard Space Flight Center Version 0 (GSFC V0) scheduler, the Upper Atmosphere Research Satellite (UARS) scheduler, the Clouds and Earth's Radiant Energy System (CERES) prototype scheduler, and the Earth Radiation Budget Experiment (ERBE) scheduling procedures (ERBE scheduling is done manually). The SeaWiFS scheduling software will be reused by the Moderate-Resolution Imaging Spectroradiometer (MODIS) oceans processing: MODIS is currently in the process of porting the code. ECS does not plan to reuse the SeaWiFS software for the Science Data Processing System (SDPS) scheduler, because of incompatibilities between their implementation and our requirements (see detailed cell in the SDR version), but will use it as a source of design ideas. The GSFC V0 scheduler is currently under development, and ECS is following its progress. It will be used as another source for the SDPS scheduler design. There were certain problems encountered when the UARS scheduler was put into operations (see detailed cell in the SDR version of the V0 Analysis Report). ECS has looked into these and use the lessons learned to avoid similar difficulties with the SDPS scheduler. We have found the operations concept for the CERES scheduler to be an excellent resource in the development of the operations concept for the SDPS scheduler. Finally, the ERBE scheduling procedures will be used in the design of the user interface for the SDPS scheduler.

Table 4-10 contains a summary of the PGS components that have been evaluated to this point.

Table 4-10. PGS Component Integration Summary

Candidate Function	Preliminary Assessment
Hardware	
None	
Software	
SeaWiFS scheduler	MODIS oceans processing is porting scheduling software for use at SCF.
LAS geolocation routines	Possible code reuse for PGS toolkit pending source code and documentation evaluation was evaluated but determined to
Design	
NSIDC automated Q/A software	Q/A ES as applied to higher level products was evaluated but determined to not be applicable for reuse.
GSFC V0 scheduler	ECS is following the GSFC/Honeywell development effort, and will use it for design ideas and lessons learned.
SeaWiFS scheduler	Not likely that ECS will reuse software for SDPS scheduler; however, SeaWiFS scheduler will be a source of design ideas and lessons learned.
ERBE scheduling procedures	ECS plans to use ERBE scheduling operations manual to help with the SDPS scheduler user interface design.
Experience	
UARS scheduler	The science data processing segment (SDPS) scheduler already reflects some of the lessons learned such as the distribution of a reprocessing request over time so as not to adversely effect regular processing
Process	
CERES prototype scheduler	Reuse of the ideas in the operations concept for SDPS scheduler
NSIDC automated Q/A software	Possible reuse of operations concept for PGS science processing as an example of Q/A automation using expert systems
MSFC automated Q/A software	Possible reuse of operations concept for PGS science processing as an example of Q/A automation using traditional coding methods such as FORTRAN

4.4.1 Distributed/Parallel Testbed (Science Software Execution Prototype)

Prototyping work has begun on the ECS Science and Technology Laboratory (STL) distributed/parallel testbed and on the Goddard Space Flight Center (GSFC) High Performance Computing and Communications (HPCC) testbed. As part of this activity, plans were to acquire, port and run algorithm code from various instruments in order to collect lessons learned for hardware architecture and algorithm integration and test. The Advanced Very High-Resolution Radiometer (AVHRR) Land Pathfinder algorithm has been successfully ported to most of the testbed computers and re-benchmarked. Some preliminary recommendations have been reported back to the developers in the area of algorithm delivery guidelines. Subsequent plans include a port to a 64-bit architecture (the code was developed on a 32-bit machine) and experimenting with multiple processors (the algorithm sequentially processes 14 orbits which are independent and could be processed in parallel). In addition to the AVHRR code, SeaWinds and SSM/I algorithms were tested using symetric multi processing (SMP). Currently algorithm execution on massively parallel processing (MPP) is being evaluated The results of this study are documented in the Technical Management Database in the EDHS under SDPS prototypes.

4.5 System Management

As presented at the System Design Review, the System Management Subsystem allocates services to both system-wide and local levels. With few exceptions, the management services are fully decentralized with no single point of failure which would preclude user access. Local system management is what is really relevant in the V0 system even though there are some system wide activities such as the V0 IMS and the X.500 Directory System. Because current V0 DAAC activities are for the most part IMS, DADs or PGS oriented, 'LSM' type activities, if any, as known in ECS are really being done as part of IMS, DADS or PGS activities.

4.5.1 Summary

Table 4-11 lists V0 reuse candidates in the area of system management. Information is still needed in various areas such as accounting management and software configuration management to do a complete analysis.

Table 4-11. System Management Integration Summary

Candidate Function	Preliminary Assessment
Hardware	
none identified	
Software	
DORRAN (accounting system from EDC)	Preliminary information has been obtained, but problems with initial operation of new USGS accounting system impacted follow-up and detailed information. Accounting is a release B function and is not being actively pursued at this time.
LaRC Risk Assessment Software (This falls under Security Management)	More information needed to determine use for V1. It is a custom developed software for risk assessment based on the NASA Automated Information Security guidelines.
Design	
none identified	
Experience	
ASF Accounting System	Implementation of pricing policy (multi tiered) is of special interest.
EDC Accounting System	This system which has DORRAN as its main component is successful
Process	
Configuration management (resource, inventory, logistics, training and maintenance management)	The process for the management of resource, inventory, logistics, training and maintenance even if it is not automated is useful for V1.

4.5.2 Component Integration

In the local system management area, the accounting management system at EDC known as DORRAN (Distributed Ordering, Research, Report and Accounting Network) is by far the most refined system (based on information so far) that ECS can take advantage of for lessons learned (experience) in the area of accounting management. Interoperability is more likely the type of integration that DORRAN will have with ECS. Another experience source is the ASF accounting management process which is not in any formal document. Most of ASF accounting is done manually and some relevant information to CSMS has been obtained. The following paragraphs discuss EDC accounting procedures.

A number of systems are being developed at EDC in-house to implement automated accounting and order tracking functions. The accounting system will be comprised of several subsystems, e.g., The Distributed Ordering Research Accounting Network (DORRAN) system is used to create users' accounts, track orders, and pass orders to the Production Control System (PCS). PCS will interface with the National Landsat Archive Production System (NLAP) and the

Product Distribution System (PDS) to produce Landsat products. Most accounting functions are automated at EDC. The DORRAN system accepts and processes orders paid by credit cards, issues refunds, prints address labels, tracks order history and prints reports to name a few.

Conceptually, there are two types of datasets at EDC; visible and non visible. Users can see the estimated price for the visible products when they are ready to order products. Users can also get a hard copy of standard prices for services and products. However, a list of prices is not available on-line to users prior to search or product orders. Two different modes of products order are provided to users ; regular mode and rush mode. For rush orders, users are charged three times the regular price. Almost every method of payment including credit cards (used in DORRAN system), money orders, checks, and even cash is honored.

The System Management Distribution white paper (Section 3.2) provides a description of accounting and accountability management in the ECS environment. There is a lessons learned section in the paper that incorporates accounting procedures at ASF and EDC.

Note: Accounting and Billing is a Release B service, focus in the past few months has been on IR-1 and Release A services. Resolution of SDR issues has included further investigation of accounting at EDC and ASF, but at a low level of effort.

4.6 Systems Engineering

4.6.1 Configuration Management

4.6.2 Integration and Test

A description of the lessons incorporated from the V0 system level testing are included in section 6, Version 0 Process Integration.

4.6.2.1 Reuse of Test Plans and Test Procedures

Reuse of Version 0 Test Plans and Procedures will take two forms: Specific test cases will be reused to regression test hardware or software from Version 0 which is being directly incorporated into ECS; and Version 0 Test Plans and procedures will be reviewed to provide general guidance on how to structure some ECS test plans and to determine if there any “lessons learned” from V0 that can benefit ECS test personnel.

ECS will be observing the system level IMS testing being coordinated by David Han. results from those tests should provide insight into the process of organizing and conducting ECS system level tests.

4.6.2.2 Reuse of Test Tools and Test Data

Reuse of test data and tools will be of two types: Direct reuse of any tools or test data that is applicable to ECS tests (including regression testing of software reused from Version 0), and reuse of test tool design. This section will describe both types of reuse.

4.6.3 External Interfaces

Each DAAC supplied information to the FAM regarding external interfaces; specifically: Affiliated Data Centers (ADC), Other Data Centers (ODC), Science Computing Facilities (SCF), Flight Dynamics Facility (FDF), Network Control Center (NCC), Instrument Control Center (ICC), Instrument Support Terminal (IST), National Space Development Agency (NASDA), European Space Agency (ESA), Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER), and Landsat. ECS was interested in both computer and verbal exchange of information.

MSFC and ASF provided the most detail regarding their interfaces with ADC and ODCs. ASF logs onto the NOAA system directly to obtain AVHRR data for their users. The parameters used by the NOAA system users to request data are currently under investigation. This information will be valuable when developing the Interface Control Documents for interfaces between ECS and ODCs/ADCs.

MSFC uses the UNIX script files to receive data from NOAA/NESDIS. Data is received using ftp and occurs on a periodic basis several times a day. In addition, MSFC uses the NSI network to exchange GOES images with the University of Wisconsin using ftp. Potentially, these scripts could be reused on the ECS System.

Further investigation is required to assess the ADC/ODC Inventory Interoperability at ASF, EDC, and the V0 System. Information/Experience is being used in the development of the ADC IRD. Additional analysis is required on other external interfaces identified in the FAM.

4.7 Maintenance and Operations of Version 0

Operations of Version 0 will provide the vehicle for each DAAC to establish its own operations concepts, processes and procedures in working with EOS for the management, maintenance and operations of a distributed information system. Each DAAC has ingested, processed, distributed and archived Earth science data for many years. The process of establishing V0 as an operational, nation-wide, cooperative, information system is an important step toward a fully functional, distributed ECS system.

By monitoring how these and other issues are resolved and refined, ECS can develop its own tools, processes and procedures to ensure a seamless transition, within the DAAC, of not just V0 to V1 operations and functionality, but also V0 to V1 management and maintenance concepts.

Based on conversations with MSFC, JPL, and EDC personnel, Version 0 activities have been heavily focused on the development of capabilities, with resolution of many M&O issues left for later in the process. For example, each DAAC will have the responsibility for maintenance of software, hardware and systems that were developed by the DAAC. However, ESDIS/GSFC will have responsibility for the common IMS. Both Don Collins (JPL) and Lyn Oleson (EDC) said that a process to work cross-DAAC problems (including identification, isolation, and prioritization) has not yet been formally established. The following sections, therefore, are conceptual because actual processes and procedures have not yet been established.

4.7.1 Maintenance and Operations Processes

The approach V0 takes to topics such as hours of operations, V0 operational availability, reliability, user interfaces, user support, and system functions will all become the "minimum" expectations for ECS. Similarly, the level of DAAC autonomy including processing control, configuration management, change control, and change prioritization will establish the initial environment for similar topics during ECS M&O activities.

4.7.1.1 Operations

Based on discussions at MSFC, JPL, and EDC, there is not agreement between the DAACs on the need for extended operations. EDC, perhaps because of their Landsat experience, expects to staff their DAAC 7 days a week, 24 hours a day. In contrast, JPL expects to staff their DAAC 5 days a week, 8 hours a day. Depending upon equipment reliability and availability results, these diverse approaches will influence users' expectations. These expectations could cause ECS to change its current 7 days a week, 24 hours a day, operations concept.

Distribution of V0 data by either electronic or physical media will also set user expectations, at least in the short term. For example, JPL currently plans to transition much of its product distribution from tape to electronic transfers by utilizing an FTP drop.

4.7.1.2 Maintenance

Discussions at JPL and EDC have highlighted that the DAACs intend to follow the V0 development model of using interfaces to control evolution of DAAC-unique developed components. Both stated that they felt the DAAC had the authority and responsibility for changing DAAC developed extensions/components to V0 and, within the constraints of the DAACs budget and SOW, didn't need permission from ESDIS to make the change. Both also stated that no process had been developed to determine maintenance or evolution paths for common software. Similarly, DAAC control of the installation/configuration change of Version 0 common software after initial operations appears to be an open issue.

4.7.2 Version 0 Integration Implications to Maintenance and Operations

As described elsewhere in this paper, reuse of V0 resources (i.e., computers, storage, networks) in envelopment, sharing, or inter-operability modes is contemplated. Each of these approaches has different implications to M&O. While the ECS contract allows the Government to transfer M&O functions to the DAACs and/or other M&O contractors (see paragraph H.22 of the SOW), this discussion assumes that DAAC ECS personnel will maintain ECS configuration items such as COTS hardware and software, application software, and software control databases/files, etc.

4.7.2.1 Envelopment

In this case, a DAAC V0 resource is transferred into the DAAC ECS system as an ECS configured and controlled item. Thus, the control of the asset is transferred, within the DAAC, from V0 to ECS. In this approach, two conditions are possible: 1) the asset may continue to be used to support on-going V0 operations in addition to ECS operations; or 2) the asset is removed

from the V0 system and dedicated to ECS. Assignment of responsibilities between ECS and V0 is shown in Tables 4-12 and 4-13.

4.7.2.2 Shared Use of a V0 Resource

In this case, V0 retains control of the resource but allocates all or part of it to ECS. Once the allocation is made, the V0 portion of the DAAC has no responsibility for how the ECS component of the DAAC manages and uses its allocation. This allocation can be either dynamic/ad hoc or static/a priori. Table 4-14 shows an assignment of responsibilities between ECS and V0 portions of the DAAC.

4.7.2.3 Interoperable Interface

In this case, ECS has a defined interface to the V0 system to access a given resource. M&O responsibilities are described in Table 4-15.

Table 4-12. Implications of Envelopment - V0 and ECS Share Resource

Activity	DAAC V0 Responsibility	DAAC ECS Responsibility
Management		
Configuration management	Management of allocated V0 resources within the context of the resource's overall configuration management	Overall configuration management of resource including configurations and resource allocations; management of allocated ECS resources
System Engineering		
Resource requirements	V0 resource requirements defined and negotiated	ECS resource requirements defined; V0 resource requirements negotiated
Resource utilization	V0 resource utilization	Combined V0 and ECS resource utilization
Performance analyses	V0 resource requirements satisfaction	ECS resource requirements satisfaction; satisfaction of negotiated V0 resource requirements
Trend analyses	V0 resource utilization and performance trends	ECS resource trends; combined V0 and ECS resource trends
System upgrade requirements	V0 upgrade requirements (including evolution)	ECS upgrade requirements (including evolution); combined V0 and ECS requirements
Operations		
Resource monitoring and control (staffing and functions)	Monitoring and control of allocated resources	Monitoring and control of allocated ECS resources and monitoring (at a high level) of V0 resource utilization
Maintenance		
H/W and/or S/W maintenance	None	Total responsibility

Table 4-13. Implications of Envelopment - Resource Dedicated to ECS

Activity	DAAC V0 Responsibility	DAAC ECS Responsibility
Management		
Configuration management	None	Total responsibility
System Engineering		
Resource requirements	None	ECS resource requirements defined
Resource utilization	None	ECS resource utilization
Performance analyses	None	ECS resource requirements satisfaction
Trend analyses	None	ECS resource utilization and performance trends
System upgrade requirements	None	ECS upgrade requirements (including evolution)
Operations		
Resource monitoring and control (staffing and functions)	None	Total responsibility to monitor and control of the resource
Maintenance		
H/W and/or S/W maintenance	None	Total responsibility

Table 4-14 Implications of Shared Use of a V0 Resource

Activity	DAAC V0 Responsibility	DAAC ECS Responsibility
Management		
Overall configuration management of resource including configurations and resource allocations; management of allocated V0 resources		Management of allocated ECS resources within the context of the resource's overall configuration management
System Engineering		
Resource requirements	V0 resource requirements defined; ECS resource requirements negotiated	ECS resource requirements defined and negotiated
Resource utilization	Combined V0 and ECS resource utilization	ECS resource utilization
Performance analyses	V0 requirements satisfaction; satisfaction of negotiated ECS requirements	ECS resource requirements satisfaction
Trend analyses	V0 resource utilization and performance trends; combined V0 and ECS trends	ECS resource utilization and performance trends
System upgrade requirements	V0 upgrade requirements (including evolution); combined V0 and ECS requirements	ECS upgrade requirements (including evolution)
Operations		
Resource monitoring and control (staffing and functions)	Monitoring and control of allocated V0 resources and monitoring (at a high level) of ECS resource utilization	Monitoring and control of allocated resources
Maintenance		
H/W and/or S/W maintenance	Total responsibility	None

Table 4-15 Implications of Interoperable Reuse of a V0 Resource

Activity	DAAC V0 Responsibility	DAAC ECS Responsibility
Management	Total responsibility for resource; must configure and manage its part of the interface	Must configure and manage its part of the interface
System Engineering		
Resource requirements	V0-ECS interface requirements defined	V0-ECS interface requirements defined
Resource utilization	V0 utilization	Tracking of resource request data
Performance analyses	V0 requirements satisfaction	V0 responsiveness monitored
Trend analyses	V0 trends	Resource request trends; V0 responsiveness trends
System upgrade requirements	V0 upgrade requirements (including evolution)	None
Operations		
Resource monitoring and control (staffing and functions)	Total responsibility for resource; monitoring and control of V0 portion of the interface	Monitoring and control of ECS portion of the interface
Maintenance		
H/W and/or S/W maintenance	Total responsibility for resource maintenance and V0 portion of interface	Maintenance of ECS portion of interface

5. Integration of V0 in ECS

Section 5 presents two areas in which V0 has been integrated into ECS. Section 5.1 identifies the ECS requirements which have been effected by Version 0. Section 5.2 discusses the integration of V0 and V1 in the TRMM Release (Release A). Section 5.3 discusses integration of data into ECS and Version 1.

5.1 Version 0 Recommendations Utilized in Requirements

Of the 673 recommendations in the User Recommendation Database (URDB), 164 are directly related to improvements, lessons, and concepts taken from V0. There has been a constant and continuing stream of such inputs related to V0 since the URDB (formerly RRDB) was activated. A listing of the items by status is shown below.

Of these 164 recommendations, 48 were taken from the May, 1994, issue of the V0 Analysis Report and will be addressed elsewhere in this report.

There were 23 recommendations that were dispositioned as Comments. These were generally an early collection of lessons learned that addressed concerns such as staffing requirements, program planning, testing, and the IMS "look and feel". These general, often rudimentary, comments were reviewed by the developers in the ECS program and influenced the direction of the program. For example, one item, #211, raised the issue the Guide's content and configuration control; this question affects both the ECS development and the operations at the DAACs. After this item was addressed by the URDB Assessment Panel it was taken to the DAAC Manager's and is currently being worked by the Science Office.

Another 31 recommendations were found to be covered by existing ECS functional and performance requirements at the time of their review by the URDB. There were 8 more recommendations that were not originally covered by ECS requirements but which, as the design matured, have now been incorporated. Four of these recommendations requested the capability for coincident searching, that is the ability to locate a set of data which is coincident in space and/or time with another set of data. This capability was not provided by V0. After a thorough review of the merits of these recommendations by the URDB Assessment Panel, it was agreed that this was a valuable tool for the science community and a CCR was initiated. This CCR resulted in a new requirement to provide this capability, IMS-0575.

Twenty-two of the recommendations were implementation suggestions based on experience with V0. These were sent to the development group to consider as part of their PDR preparations. They have used these recommendations in the creation of the level 4 requirement and design documents. At this point, over 60 draft level 4 requirements are traceable to the recommendations. These requirements have addressed various aspects, such as providing legends associated with browse images, displaying data timelines for data selection, obtaining the status of queries, and the ability to manipulate saved search results.

Six recommendations are currently undergoing technical assessment in the URDB. In this process the benefits and impacts are examined to determine whether a CCR is warranted to incorporate the request. Three of these recommendations deal with displaying the satellite orbit plots on coverage maps. Two raised the issue of linking the coverage map function with other client functions. The remaining item requested that ECS establish a Standard Data Format support lab. All three issues will be addressed before the SDPS PDR.

Two items were rejected during their review in the URDB. One requested that ECS provide access to a non-existent NOAA database. The other asked for the ability to manipulate browse images, but, since these images are pre-defined by instrument teams, this is not possible.

At this point, 23 items are being re-examined by the URDB screening team. Two are related to other recommendations that have already been incorporated in the L4 requirements definition process. Four are related to the ECS pricing policy, which is still being defined. The remaining are pending the completion of various design studies.

Closed-Comment

#132 Personnel requirements for ingest and archive driven by diversity of data types

#146 Emphasis of SYSTEM over DATA.

#152 VO IMS GUI CHARACTERISTICS

#157 Flight project support: Need Archive Plan

#158 Flight project support: use of ICDs

#181 SDFWG participation in V1

#211 Investigator knowledge base

#212 Additional control of query results display

#224 stress testing

#229 Integrated COTS UIs

#230 Terminology in menus

#234 Users prefer whole query form

#235 Browse granule id select

#239 Consistent menus/buttons

#243 Various results display details

#253 Minimize path delay

#254 Granule numbering

#260 Processing levels on search window

#268 Why got 'hit'

#270 Rule for polar mapping

#278 Various input about software used in V0 IMS

#280 Multiple windows flexibility vs clutter

#295 EP Plan per DAAC

Closed (Existing Req)

#134 Granule metadata, in-situ, causes large volume and long search times

#139 Metadata in IMS for holdings at SCFs

#143 Should have review and mechanisms for removal of data from the archive

#144 Read Software

#148 Distributed archive catalog

#161 Granularity varies at the various DAACs

#167 Simple, portable tools needed

#168 Development of API to common data structures

#207 Tools for guide documentation

#214 Additional content of metadata requested

#215 Summary statistics search

#220 Extensibility

#222 Accommodate EDC wall gracefully

#223 GIS search approaches

#226 Automated tools for assisting ingest

#246 Help and tutorials

#269 Security

#271 Multiple emails

#272 Order by package

#335 Summary comments on IMS: password-protect ordering

#396 Dataset specific metadata

#399 Expert and novice modes

#404 Data visible by granule or by granule "package"

#406 Automatic usage statistics reports

#407 User registration and validation for restricted datasets

#408 "Movie loop" browse

#411 Second round of query on previous query's results

#414 IMS map of functions

#417 Preferred media in user profile

#418 Save and retrieve query (search criteria)

#548 User interface functionality self-contained, segregated from ECS architecture characteristics

Closed (New Requirement)

#136 Coincident search--in-situ and remotely sensed data

#208 Hierarchical document management

#216 Search on processing history

#217 Coincidence searching

#221 APIs--interoperability in the reverse direction

#227 Various complex query support

#275 Coincident search

#398 Coincident search

Design Consideration

#162 Content-based metadata, to reflect quality, done automatically

#178 Use of HDF as baseline for ECS SDF

#182 Distribution of NCSA tools and information with products.

#198 Varying GUI display sizes

#209 Various browse features

#210 GUI portability

#219 Alternative visualization paradigms

#262 Selection list

#265 Timeline

#267 Valids backout

#273 Georeferencing

#324 Order summary window

#325 Timeline

#340 On line Help

#400 Categorize and save not only the query but the results(?)

#402 Timeline

#403 Number of granules and volume displayed as soon as recieved

#405 Request tracking, usage and accounting facility available to all DAACs

#410 Save and email of query results

#413 Help: terms

#415 Specify four corner coverage direction

#419 Query of and display browse of orbital data that wraps around the globe

Assessment

#180 SDF Lab

#191 Orbit plots in coverage map

#264 Orbital model

#397 Orbit model as part of coverage map

#412 Use of coverage map to select a specific granule

#553 V0 IMS visualization capabilities (implied minimum ECS standard)

Rejected

#213 Interoperability with NOAA phenomenology data base

#420 Select projection for display of browse data

Screening

#130 Pricing policy: unforeseen procedural bottleneck

#142 Levels of service required for different data types

#190 DAAC-selectable database toolset

#218 Automatic billing

#225 Data Dictionary particulars

#263 Legend and description label in browse products

#274 Cost accounting

#277 Window size constraints for portability

#279 User model statistics that can be used in ECS modeling

#336 Summary comments on IMS: tutorial

#401 Machine to Machine interaction

#409 Keyword aliasing

#416 Dependent valids narrow as query is entered

#538 When using the V0 IMS, I found it inconvenient to be require to always have to specify geographic coverage in my query

#545 Desired characteristics of selection lists

#549 ECS must be consistent with V0 GUI Style guide

#552 Desired IMS software support - specific list

#567 Coincidence searching definition detail

#582 back space in the VO IMS does not work.

#589 automatic set up for image contrast.

#590 cloud cover information of area of interest

#592 correction on #590

#659 accounting services need to understand user discounts

V0 Analysis Report Items

#672 Candidate VO Function for Reuse: IMS server cookbook

#673 Candidate VO Function for Reuse: GUI

#674 Candidate VO Function for Reuse: Guide Software

#675 Candidate VO Function for Reuse: IMS Staff experience

#676 Candidate VO Function for Reuse: Tirekicker Involvement Process

#677 Candidate VO Function for Reuse: Network Routers

#678 Candidate VO Function for Reuse: Network circuits

#679 Candidate VO Function for Reuse: LAN Network Components

#680 Candidate VO Function for Reuse: V0 Network Services Experience

#681 Candidate VO Function for Reuse: WAN design

#682 Candidate VO Function for Reuse: LAN Design

#683 Candidate VO Function for Reuse: Anonymous FTP

#684 Candidate VO Function for Reuse: X.500 Directory Service

#685 Candidate VO Function for Reuse: Listserv

#686 Candidate VO Function for Reuse: E-mail Forwarding Utility

#687 Candidate VO Function for Reuse: Bulletin Board Service

#688 Candidate VO Function for Reuse: Gopher interface

#689 Candidate VO Function for Reuse: World Wide Web interface

#690 Candidate VO Function for Reuse: V0 Information Services experience

#691 Candidate VO Function for Reuse: Display Results Human-Machine I/F

#692 Candidate VO Function for Reuse: Distribute Status Human-Machine I/F

#693 Candidate VO Function for Reuse: Dumb Terminal Human-Machine I/F

#694 Candidate VO Function for Reuse: Guide Search Human-Machine I/F

#695 Candidate VO Function for Reuse: Inventory Search Human-Machine I/F

#696 Candidate VO Function for Reuse: Order History Human-Machine I/F

#697 Candidate VO Function for Reuse: Product Request Human-Machine I/F

#698 Candidate VO Function for Reuse: User Comments Human-Machine I/F

#699 Candidate VO Function for Reuse: User Registration Human-Machine I/F

#700 Candidate VO Function for Reuse: Human-Machine I/F Experience and Process

#701 Candidate VO Function for Reuse: LaRC User Interface

#702 Candidate VO Function for Reuse: NSIDC Guide Authoring Tools

#703 Candidate VO Function for Reuse: EDC-GLIS coverage map

#707 Candidate VO Function for Reuse: EDC Wall Algorithm

#708 Candidate VO Function for Reuse: DAAC archive components

#709 Candidate VO Function for Reuse: Media devices

#710 Candidate VO Function for Reuse: Data Set Specific Software

#711 Candidate VO Function for Reuse: Data compression software

#712 Candidate VO Function for Reuse: DADS Experience and Process

#713 Candidate VO Function for Reuse: LAS geolocation routines

#714 Candidate VO Function for Reuse: NSIDC automated Q/A software

#715 Candidate VO Function for Reuse: GSFC V0 scheduler

#716 Candidate VO Function for Reuse: ERBE scheduling procedures

#717 Candidate VO Function for Reuse: PGS Experience and Process

#718 Candidate VO Function for Reuse: Automated Q/A Software

#719 Candidate VO Function for Reuse: DORRAN (accounting system from EDC)

#720 Candidate VO Function for Reuse: LaRC Risk Assessment Software

#721 Candidate VO Function for Reuse: ASF Accounting System Experience

#722 Candidate VO Function for Reuse: Configuration management (resource, inventory, logistics, training and maintenance

FAM cells entered as reuse recommendations in the URDB. The entry of FAM cells as distinct recommendation for reuse in the URDB provides a means of formally tracking the disposition of the candidate functions for reuse. The danger of analysis reports is that they are forgotten as quickly as the reports are distributed. Entry of the FAM cells into the URDB provides a mechanism for continuing to view the reuse recommendations as open items until a final decision is made on their reusability. The URDB committee maintains status on the FAM cells as entered in the URDB, and it maintains status updates from the segments on the suggestions for reuse as the V1 development progresses.

5.2 Integrated VO and ECS System Component

A complete presentation of this approach is included in ECS white paper 420-WP-002-001, Potential Integration of V0 and V1 Components for Release A. The proposed integration of System-V0 and ECS V1 components to form the Release A configuration is shown in Figure 5-1. The gray lines indicate interaction between components during a user session; black lines transfer of data from one component to another to allow them to work; dashed lines are connections which need further analysis. The key characteristics of this configuration are:

1. The System-V0 client is retained for Release A as the primary user search agent, receiving inputs from the System-V0 CHUI and GUI clients. (*see point 5 below*)

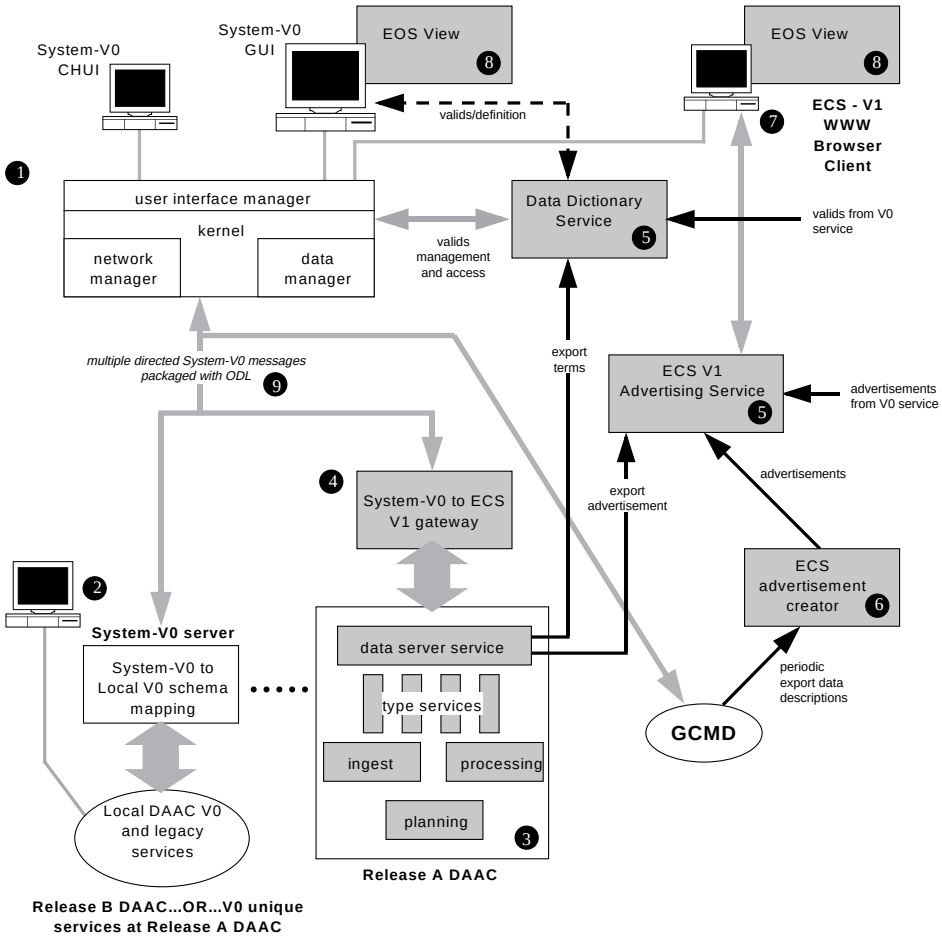

Figure 5-1. Integrated V0 and V1 Release A Concept

2. The majority of DAACs not involved in the Release A delivery will continue to operate with the System-V0 client in the same way as before. In addition DAAC specific

functionality at the Release A DAACs which is not replaced by ECS V1 functionality will still be supported by DAAC specific interfaces.

3. At the Release A DAACs the provider level services, including science processing at LaRC and MSFC will be developed and installed as described in the ECS V1 design documentation and release plans. This will include all Release A functionality for the Data Server, Ingest, Planning, and Processing Subsystems.

4. A gateway to provide translation between System-V0 protocol and the chosen ECS V1 protocol(s) will be developed to allow requests placed via the System-V0 client to be handled by the new Release A functionality. The primary interface from the gateway to ECS will be to the data server service CI, which is part of the Data Server subsystem. This gateway has always been in the Release A plan to allow a migration from V0 to V1 interoperability.

   The integrated V0 and V1 component strategy discussed here will make the development of this component much easier since it will avoid the gateway having to be developed against a constantly changing and separate system; the design processes will be brought together under a single CCB (see Section 3.2.1).

5. Two components from the ECS architecture are added to the configuration to support the System-V0 client.

   The Data Dictionary Service will provide terms and definitions which could be used to semi-automate the management of the list of permitted values (’valids’). The Release A Data Servers will be able to automatically export data dictionary updates to the service as part of the schema management approach in ECS V1. The manual export of ’valids’ from V0 services (see Section 3.1) will be to the Data Dictionary service.

   The DD service can then be used by the System-V0 client to access the controlled ’valids’ list. In addition the GUI interface could also access this service directly to get the current ’valids’ at session start-up. Obviously caching could be used to prevent repeat copying of the same data.

   Figure 2-3 also shows the use of the Advertising Service. This would be used as an operational prototype for providing users with one service from which to discover all of the services that are available in the Release A time frame.

   The Advertising Service would receive advertisements from both the V1 and V0 services. The V1 functions will provide a managed solution to the formatting and export of advertisements. For V0 services the advertising process may be more manual.

6. One strategy for populating the ECS Advertising Service with information on services held outside of ECS, is to utilize information held in the Global Change Master Directory (GCMD). This would allow a user to find earth science data services (and the data associated with a service) within ECS and elsewhere from a single service. It is proposed that for Release A the population is achieved through a periodic (quarterly) update from the GCMD by basic manipulation of an export of all of the data set entries in DIF format. Each data set not already advertised as part of the EOSDIS services would be advertised with either a telephone contact service or a URL to further information. The Advertising

Service design is likely to support a multiple views (layers) on advertisements so that an EOSDIS only view can be obtained. [Note: even within the EOSDIS services there are likely to be several views; e.g. V0, V1, mandated services, DAAC unique etc.].

7. To ensure immediate widespread access to the Release A system it is imperative that a WWW browser interface is developed. With the startling rate of functionality advances within the WWW, it is clear that a reasonably capable interface could be developed[1]. This would ensure that there are no artificial barriers to widespread use of Release A as soon as it is released [Note: this is an important issue with less than a year scheduled between Release A and Release B there is a very real danger that the normal inertia involved in user access to a new system would mean that the system is essentially unused until Release B is made available].

   The Advertising Service component will already be developed to work with WWW browsers via an HTTP interface. The System-V0 client would need to be developed to support the HTTP protocol and provide HTML interface definitions.

8. The EOSVIEW tool for local viewing of HDF formatted data will be made available for users of either the WWW browser or System-V0 GUI to unpack and view any data delivered in EOS-HDF format. The degree of integration of EOSVIEW with each interface needs further analysis; as a minimum it would be a standalone tool the user has access to. [Note: the tool will work with either general HDF files or the products using the HDF-EOS structures. More information will be available for the latter products]

9. The System-V0 query/result messages and ODL packaging would be unchanged. There might be some benefit from using a message passing protocol other than TCP/IP sockets for communicating between the client and server (see Section 3.1).

5.3 Integration of Version 0 Data

Data Migration. Version 1 is a complete system comprised of Version 0 and ECS components. As such, all data that is currently in Version 0, is automatically in Version 1. The V0 data will either migrate to the ECS component of the DAAC or remain temporarily in the V0 component of the DAAC. V0 and ECS provide bi directional interoperability so that users continually have access to all data at all times. ECS has the responsibility for supporting the migration of the data. A paper has been published to define the process. This process has been reviewed and discussed with the Version 0 staff via meetings (DAAC UWGs, DAAC TIMs, DAAC managers meeting) and a PDR workshop specifically on this topic. The White paper titled, Version 1 Data Migration, (160-TP-002-001) is available through the ECS Electronic Data Handling System (EDHS).

Data Design. Version 0 developers have been active in the definition of the layers of the data pyramid through participation in the Data Modeling Working Group, chaired by Denise Heller. This group is responsible for production of the lexicon, the taxonomy, and the Core Metadata

---

1 There are already several effective interfaces to data services using relatively standard WWW functionality, and there are several R&D activities in the public and commercial domain looking at GIS interfaces within a WWW application.

Model. Specifically, the metadata for the V0 data sets identified for Release A has been compared to the ECS Core Metadata model. The comparison resulted in modifications to the Core Metadata model. The modifications will be reflected, by DAAC, in appendixes to the SDPS database design specification (DID 311) being released in parallel to this document. The appendixes identify: addition of aliases, addition of attributes, and broadening of domain values.

This page intentionally left blank.

6. Version 0 Process Integration

6.1 Introduction

This section addresses the high level aspects of Version 0 development including the use of the system level component as an integrating factor between the heterogeneous environments of the DAACs, the interaction between the DAACs and the science community, and high degree of autonomy maintained at the DAACs.

6.2 V0 Development Process as a Model for ECS

Specific areas which have been identified as models for ECS development are:

- DAAC use of the UWGs for feedback and evaluation of early designs
- V0 use of tirekickers for in depth analysis and feedback on the V0 system level IMS

The means of incorporating those lessons learned in ECS development are listed below. Each is explained in further detail.

- Evaluation Packages
- DAAC evaluators ("tirekickers").
- Technical Partnerships
- Integration of V0 IMS team into ECS development.

6.2.1 Evaluation Packages

Evaluation Packages are early prototyping of ECS functionality. As in EP3, this includes mockups of potential functionality. A few of the DAACs (LaRC and MSFC) were provided valuable feedback from their user community to allow the user interface to meet the wide demands of the users. Following this lesson learned, EP3 is a series of mockups of new functionality and functionality built upon successful V0 features such as the timeline. The EPs are designed to evolve easily responding to the changing needs of the community and the emerging architecture of ECS.

6.2.2 DAAC Evaluators

DAAC evaluators are being used to evaluate the EPs,. This is a broadening of the concept of tirekickers used in Version 0. Evaluators have been identified for most of the DAACs at this time. The evaluators generally range from User Services personnel, to Version 0 developers, to DAAC scientists. Each of these types of evaluators has a unique perspective on the developing ECS system. By capturing different points of view, the ECS team can ensure that the ECS system meets the needs of users as well as operators. In addition the Version 0 developers can provide the benefit of their experience in developing Version 0 systems.

6.2.3 Technical Partnerships

Technical Partnerships are an informal process whereby ECS technical experts and DAAC technical experts are put in direct contact with each other for their mutual benefit for the exchange of technical information. This is not a managed task and site liaisons are normally only the facilitator for putting the experts in touch with each other. This activity has the feature whereby both experts increase their productivity by sharing information and sometimes work load.

An example would be where the two experts are working on the same research task. In this example, the task is split into components and each work a unique set of components and share their results and conclusions. Another example is where two experts have independent sources of information that can support each other. Yet another example, is where two experts cover the same seminars and trade shows but agree to cover for one another in case they have scheduling conflicts or intentionally want to reduce the number of events covered.

6.2.4 Integration of V0 System IMS Team

Integration of V0 System IMS team into ECS has just been initiated at the writing of this document. An agreement has been reached for key V0 system engineers to support the ECS new architecture. Support will vary according to the expertise of the V0 person. Identified areas include data dictionary work, client sub architecture, and system engineering.

6.3 V0 System Level Testing - Lessons Learned

This section presents lessons learned from the V0 System Level testing that occurred during the summer of 1994 (June-August). The intent of these lessons learned is to provide information to the ECS development and test organizations that will improve the quality and timeliness of the test process for Version 1 and beyond.

This section provides general lessons learned from the V0 testing process, and does not describe specific recommendations about the V0 system (such as recommended improvements to the V0 IMS). Many of the ECS site liaisons (science and systems engineering) were involved, along with several ECS test engineers. This section summarizes their involvement and comments.

It should be noted that this lessons learned section was generated from input from a number of testers, and as such is a synthesis of that input. On the basis of the comments received from the V0 testers, this section was broken down into four major areas: Test Planning, Test Method (including test conduct), Test Results and Systems Engineering. ECS has already implemented some of the items that these lessons learned indicate should be done; in other cases the lessons learned need to be implemented. After each lesson learned, a summary is presented of what has or should be done based on the V0 testing experience.

6.3.1 Test Planning and Scheduling

This section presents lessons learned related to the test planning and scheduling process, including the resources (people, tools, and hardware) available for the test effort, and the roles

and responsibilities of the different organizations (each DAAC, the ESDIS project, HSTX, etc.) involved in testing.

6.3.1.1 Plans and Schedules

Lessons learned were captured from the planning and scheduling for the V0 testing - was there enough time allocated, how useful were test plans, and was the distributed nature of the testing an impediment to effective testing?

One tester commented on the testing process itself, which he thought was not performed in an efficient way. No clear guidance on logging on the system and using the system was provided and the users manual was not available before testing the system.

Lesson: Having users' manuals and systems operations procedures well defined and available will be an important part of successful testing for ECS.

What ECS has/should do: Develop Users manuals and Operations manuals prior to the Consent to Ship Review (CSR), so that the documentation will be available to all involved parties for system acceptance testing at the DAAC's. Having these manuals available is still an open issue.

In addition, Hughes must do test procedures under the terms of the Statement of Work (SOW), which requires detailed preparation prior to the start of acceptance testing.

6.3.1.2 Resources

This subsection identifies lessons learned about the adequacy of resources available for V0 testing.

1) The tester at one of the DAAC's commented that the site developed their local test plans entirely on their own, which was a significant amount of work. These plans appeared to be well constructed and thorough. These locally developed test plans were largely unused after the first few weeks of testing, because modifications in the IMS client made the original test plans inaccurate, and there was insufficient staffing to keep them updated. Therefore, as testing proceeded, most of the test rework was done in an ad hoc manner.

2) The tester noted that the significant amount of rework seriously strained the resources of the DAAC, as it lasted quite a bit longer than originally planned.

Lesson: Development of test plans/procedures is not enough; adequate resources should be allocated to ensure that plans can be updated, so that testing is more than just "ad hoc"

What ECS has/should do: HUGHES should consider some method for "automating" test procedures (automated templates, automated re-numbering of step numbers in procedures, etc.) to reduce the amount of manual effort associated with maintaining these documents. (Test plans, as planning documents, will not be changed once approved by the customer.) HUGHES must also allocate adequate resources to test procedure updates. Hughes will also keep a test conductor's log during testing that will track all changes to the procedures, redlines will be made to the procedures, and all changes that are made will be captured in the test report package.

6.3.1.2.1 Tools

There were a number of comments related to the use/non-use of automated testing tools during the V0 testing. This subsection identifies lessons learned which can be applied to ECS.

1) Several testers stated that the client should have been tested for memory leaks.

2) One commented that the client should be tested on a platform that has the minimum required hardware configuration.

Lesson 1: A memory leak detector tool would be beneficial, especially for testing of the ECS Client.

What ECS has/should do: HUGHES is currently evaluating tools for the development environment; a memory leak detector tool should be made a part of this environment.

Lesson 2: Testing should be done on a variety of hardware configurations prior to shipment to the DAAC's, especially on platforms configured with the minimum hardware required.

What ECS has/should do: Test the ECS client and Instrument Support Terminal's (IST's) on all contractually required hardware platforms prior to deployment to the DAAC's.

1) One tester strongly recommended that a session recording facility be built in so when a user hits a problem, the operations that the user did leading up to that occurrence can be retrieved, because most often a user won't remember exactly what he did to get to the point where the problem occurred.

2) Similarly, the tester stated that questions about timing could be addressed automatically, without requiring the user to use a stopwatch. "Why can't the system keep track of how long it took to fulfill a request?"

Lesson: An automated tool should be used to record "free form" testing, and another tool for measuring system response times.

What ECS has/should do: HUGHES has procured the Mercury XRunner and LoadRunner testing tools. XRunner has the capability to capture and playback a user session. The tool captures all keyboard and mouse movements/button clicks. This tool will be used during system integration and acceptance testing. HUGHES has also procured the LoadRunner tool, which can

be used to simulate multiple simultaneous users. LoadRunner measures all transaction response times (i.e. time between a user submitted query and a response from the system back to the Client).

One tester thought that the V0 test effort would have benefited from an automated Discrepancy Report (DR) tracking tool. Multiple DR's were sometimes generated for the same problem, and there were difficulties in tracking and managing all of the DR's.

Lesson: An automated DR tracking tool should have been used during testing, and more resources should have been allocated to tracking and resolving DR's.

What ECS has/should do: HUGHES has procured the Qualtrak DDTS tool, which automates the DR tracking process and can be used from remote locations via networks such as the internet.

6.3.1.2.2 Roles and Responsibilities

This subsection identifies lessons learned related to the division of roles and responsibilities between the various organizations involved in organizing, conducting and supporting the V0 system testing.

Several testers thought that there was not enough interaction between the Version 0 Systems Engineer at GSFC, and the Hughes STX developers.

1) One tester thought that roles and responsibilities needed to be well defined before testing starts (between different DAAC's, testers, systems engineering, etc.).
2) He also stated that the DAAC personnel were involved and helpful - "They have a good knowledge of their DAAC and can help isolate problems".

Lesson: If clearly defined roles and responsibilities are important for V0, then it will be even more important for ECS, which will have a large number of different organizations involved in the test process (DAAC's, ESDIS project, ECS, scientists, IV&V contractor, etc.).

What ECS has/should do: ECS will need to work continuously with the different organizations and the ESDIS project to ensure that every one's roles and responsibilities are defined in writing and agreed to before site testing begins. HUGHES will also need to ensure proper coordination between the development, system and acceptance test groups during the system integration and test effort. It will also be important to have the DAAC operations and maintenance personnel available to participate in the acceptance testing.

6.3.2 Test Method

Three basic methods were used during the V0 system testing; functional, scenario and regression. Functional testing is the traditional test method, in which each system function is tested and verified to be working. Scenario based testing uses "real life" scenarios (i.e. testing the system by using it as it will be used by the science community during normal operations). Regression testing is re-testing of parts of the system that have already been tested, to ensure that software fixes and/or new functionality added during the latest build has not caused the system to

fail somewhere else. Each of these methods (plus performance and stress testing) will be used on ECS.

6.3.2.1 Functional testing

The following lessons pertain to functional testing.

Two testers noted that while the scenarios were good, more functional testing should have been done.

Lesson: In addition to the "science" scenarios, more functionally based testing should have been done (possibly before the start of the distributed system wide testing.

What ECS has/should do: HUGHES has already begun development of detailed System Integration Test Plan (DID 402/VE1) that will test every function of the system. These will be followed by detailed Test Procedures (DID 414/VE1) that will be run at the ECS Landover facility. These test plans and procedures are requirements driven, which should result in more complete functional tests to verify those requirements.

6.3.2.2 Scenario Based Testing

1) Another tester noted that it was a good idea to come with the science scenarios. They made him aware of many options that he wouldn't have otherwise discovered until much later, such as the global map projection (almost 3-D) of a dataset. They also showed nicely the capability of doing multi-DAAC searches. He went on to say that many users may not test other DAAC's, since most users are associated with a single DAAC.

2) The same tester also believed that the problem with scenarios is that most bugs and problems can't be found that way. He stated that scenarios are good for PR and as a starter, but they are only one of many routes a user may take. That route will be tested extensively, but others will not be uncovered. This tester found most problems during free testing. (Ex. he crashed the system when he ordered without specifying the data medium. Normally, he would have specified the medium, but noted that the system shouldn't crash when something unusual was done). He noted that this was a bug and was fixed. He concluded that there should be extensive free testing by capable testers to uncover problems as well as uninformed testers who are also useful.

Another tester stated that "The V0 test scenarios were good - they used scientists and DAAC personnel to generate realistic scenarios. However, the scenarios did not cover every function, and more functional testing should have been done. "

1) Still another tester stated that the “V0 testing started out using canned scenarios, with all actions pre-defined. The user community doesn't need to be involved with this.”

2) Later he was allowed free reign, where he could just move around in the system at will. “This was fun and useful as well since it uncovered some problems.”

Lesson: The scenario based approach to testing used by V0 has a lot of merit, especially in demonstrating the use ability of the system from a scientists point of view. However, functional testing and “free form” testing are also needed for thorough testing of the system.

What ECS has/should do: ECS is already gathering science scenarios (this is being done by the Science Office), and the integration and acceptance test groups are referencing these scenarios in the test plans. More work needs to be done to include additional science scenarios and also operations type scenarios (for FOS and M&O functions). As mentioned above, functional testing (in order to verify requirements) will be performed in accordance with the system integration test plans and procedures.

Hughes should also allow users time for “free form” testing prior to each release.

6.3.2.3 Regression Testing

The following lessons pertain to Regression testing.

One tester felt very strongly that insufficient time was allotted for regression testing during the build/test cycle.

Lesson: More time needs to be allocated for regression testing of existing software as more functionality is added and/or fixes are made. Without sufficient regression testing bugs that were introduced in an attempt to fix something else or as a result of new code will go undetected.

What ECS has/should do: Hughes must make sure enough time and resources are allocated to the regression test effort. The use of the XRunner tool (mentioned under “Tools”) is specifically designed to automate the regression test process and should help ensure sufficient regression testing is done.

6.3.3 Test Results

The following lessons pertain to the results of the V0 system testing, and how those results may be relevant to the V1 testing.

1) One tester noted that there were lot of ambiguities in selecting the valids in the search field, and the instructions provided in the Users Manual were not very clear. He found that null results were obtained even when a known data set and the data center were selected in the directory search field. He thought that this may be due to the fact that the database was not updated at the time, or that the search criteria needed more fields than those were defined, but noted that no clue was given by the system and that the system failed to provide any help on the specific items selected.

2) This tester also found that searching between subsystems (e.g. inventory results to and from directory information) was unreliable, so it is best to confirm your search criteria if given the option (Note: Go To Inventory from Guide documents was not implemented when this test was done). He concluded that when you confirm a search, you should take note of the search type and make sure it changes to the type search you want to perform.

Lesson: Test Procedures should include the correct responses to at least a subset of the queries being used in the tests. These can be generated manually based on what is known to be in the archives.

What ECS has/should do: Ensure that the test groups generates expected results for a sub-set of queries before testing, so that these results can be used to verify that the correct responses are received. The test group must also work with the DAAC's and the Science community to ensure the proper test data is selected for testing the systems functionality.

1) One tester felt that system response time was very slow at times - and that this affected testing, and prevented completion of some tests.

2) He also found that the same query may return different results (For example, if the user requests 100 of 500 available granules, the archive software will not always select the same valid granules, and thus the same query may return a different set of results).

3) Finally, this tester thinks that the software should be ported to all required platforms and thoroughly tested before starting system testing.

Lesson 1: Much of the performance problems with the system were due to inadequate hardware and the internet.

What ECS has/should do: Performance testing must be an integral part of the system integration effort, to ensure that performance is adequate prior to delivery to the DAAC's. In addition, as much testing as possible should be done on Clients that are on local area networks, so that the vagaries of the internet can be avoided. The Mercury LoadRunner tool was procured to test system performance (as well as load and stress testing) and should uncover performance problems early in the integration test process.

Lesson 2: The same query may return different results. This is an important lesson, and could result in significant time savings, as test engineers may interpret differing results as a failed test.

What ECS has/should do: This lesson must be made widely known to the test staff.

Lesson 3: Adequate time and resources must be built into the development cycle to test the Client on all required hardware prior to system level testing (and especially acceptance testing).

What ECS has/should do: Make sure the software is ported and tested on all contractually required hardware before the Consent to Ship Review (CSR), and make the results of all testing related to porting available for review at the CSR. Hughes must also ensure that responsibilities for software porting are well defined and scheduled between the ECS development and test groups.

6.3.4 Systems Engineering

This subsection contains lessons related to the overall systems engineering effort directly related to testing, but not part of the actual test effort.

6.3.4.1 Software Deliveries During the Software Build/Test process

1) One testers experience led him to believe that there was a lack of sufficient systems engineering oversight of the IMS development and test phases. He concluded that the consequence was that the Integration and Test phase occurred in such a manner that significant rework was required, and the result was a product about which there was a low level of confidence by the people that fielded the software. He went on to state that because of the lack of systems engineering controls, the test phase came to be regarded as `fluid', with a subsequent difficulty for anyone involved in the process to schedule their efforts. This caused trouble with other activities at the DAAC, which were impacted by the staff doing a lot of test rework on short deadlines with short notice.

2) He noted that it was not uncommon for tests to fail, and that some failures were of such a nature that it was difficult to believe that the software had been adequately tested prior to release. He found that when fixed code was tested, the original bug was sometimes still evident.

3) Finally, he stated that the "Help screens were not added until late in the process. This meant that there was no real test of how clear and well-written the help screens were prior to general release. "

Lesson: Software needs to be adequately tested by the development organization prior to turnover to the system integration and testing and acceptance testing groups. In addition, when software fixes are implemented the code should be tested in a controlled environment, before the fixes are released for system testing. The delivery of on-line help should not be delayed until after system testing is largely completed. Not having on-line help not only means the help screens don't get tested, it also make it difficult for anyone who does not have a good knowledge of the system (such as scientists) to do use ability (scenario type) testing.

What ECS has/should do: Hughes must maintain integrity in the process by providing a strong test lead who uses the configuration management (CM) system to control the environment. The test lead acts as the gatekeeper preventing software from entering test until problems encountered in the previous test phase are resolved to a sufficient level to make testing

worthwhile. The ECS Quality Office (QO) will monitor the process to ensure compliance and use its direct path to upper management to influence the correct functioning of the process.

With regards to on-line help, the build delivery schedule must be planned to include this functionality before system testing is complete (something that is often not done in the rush to get other "more important" functionality working).

> One tester thought that the heritage code used in the system caused problems during integration and test, and noted that heritage code may not function exactly as expected.

Lesson: Heritage code should be thoroughly reviewed and analyzed prior to its incorporation in the system. Even after analysis, it should be expected that heritage code may need to be refined to make it function as needed.

What ECS has/should do: Since heritage code is a major element in the ECS, procedures should be implemented to ensure that the code is robust and of high quality before it is delivered. The ECS Quality Office is working on these procedures.

6.3.4.2 Tracking Recommended System Improvements During the Test Process

Many testers submitted recommendation on improvements to the V0 IMs, both new functionality and modifications to existing screens/functions. These recommendations may be relevant to the ECS client and should be captured for future evaluation. They are not presented here, but should be reviewed for submittal to the User Recommendations Data Base (URDB).

Lesson: There will undoubtedly be many recommendation for improvements to the ECS system that will be worthwhile and should be included in future releases of the system.

What ECS has/should do: Make sure that the URDB (or a similar system) is available to the different groups involved in the ECS testing at the sites.

6.4 V0 User Feedback Lessons Learned

At the time that this working paper was published, there was fairly little user feedback to derive lessons for ECS. This section will be updated at a later date.

Some of the ECS team participated in a V0 tirekicker session with Dr. David Emmitt's group of scientists. Each team was comprised of an ECS person, a V0 person and a scientist. A separate report will be coming out from the Version 0 team. The major points noted were:

- Credibility in the system.: This is mainly due to the design and maintenance of the valids
- User interface: This was both in terms of the user interface layout and design of on-line help.

Appendix A. Version 0 Functional Analysis Matrix for ASF, EDC, GSFC, and JPL

Version 0 Functional Analysis Matrix (July 1994)

Revision 8

SDPS	ASF	EDC	GSFC	JPL
System Access & User Registration 1. User Registration - User authentication - User profiles	Now: Submission of 2 page proposal required - NASA approval required (ASF has a restricted data set). User Services register approved new user (creates accounts, sys. authorization, etc.). Account password authentication is done. Minimal user profile contains shipping addresses. In V0, ASF will be compatible with user authentication and profiles.	System is open to all for most functions. Registration required to place orders. GLIS was the foundation for the V0 IMS. V0 asks for the users affiliation while GLIS extracts the general affiliation from the users e-mail address (e.g., "edu").	User Registration, User profiles (organization, occupation address, etc.) ESDIS IMS. User profile inf. is subset of local GDAAC profile inf.. **Password required only for restricted data access.**	User profiles is a superset of what ESDIS IMS will have. Shipping information, but no billing information. Use both a fixed distribution list and users calling User Support Office if they need data, or to be added to distribution list.
2. Dumb Terminal Support - Dial-up - Network connection with terminal	ChUI with graphics extensions for Internet and Mac/PC modem users.	Character GLIS on PC as well as on UNIX	Yes - Alpha numeric IMS **Dial-up and Network connection**	Yes
3. Executive Function - Higher level menu that provides single access to all ECS applications	Not a V0 Function.	Not a V0 Function.	Not a V0 Function.	Not a V0 Function.

	ASF	EDC	GSFC	JPL
Algorithm Integ. & Test 1. Tools - Standards checkers (coding standards, PGS toolkit use) - Code checkers, static/dynamic/performance analyzers - Resource management tools - Development environments (compilers, linkers, debuggers, etc.) - CASE tools - Data checking tools - User interface	Planned for Radarsat upgrade.	LAS tool, ADAPS reused. C, FORTRAN, TAE CASE tool Software Through Pictures, Purify (a code cleaner like lint), Code Vision Geometric Correction and Atmospheric Correction code reused extensively.	Planned SGI Code View. SGI development tools C, C++, FORTRAN. Kronos scheduler planned with LISP compiler. Utilities to gather information on CPU usage referenced in SeaWiFS mini-test procedures.	TOPEX/POSEIDON merged GDR algorithms for T/P enhanced level 2 and level 3 products have been provided by the TOPEX and POSEIDON projects and members of the TOPEX SWT Will archive algorithms for EOS ALT reprocessing. Algorithms provided by E. Rodriquez will be used for a new geophysical product from TOPEX Altimeter SDR. Product specific QA tools [MGDR, Pathfinder] Data production string for MGDR. CD-ROM pre-production capability. Pathfinder data processing string.
2. Procedures - Algorithm delivery procedures (New algorithms, Updates to existing algorithms, Updates to calibration and other data files) - Documentation of procedures - Formats/templates for reports, test plans, and other required documents - Creation of algorithm metadata	For Processor, team evaluation for Level 1 and UWG review for Level 2.	Anytime change is made to LAS I&T is done but not formally documented. There is a standard Project Request Form (PRF) used to get change approval but each project monitors its own requests and has their own PRF tracking system.	AVHRR Transition Plan **4/18/94.**.	Yes. Data Management Plan (DMP) System Integration and Test Plan (SITP). Configuration Management (CM).

	ASF	EDC	GSFC	JPL
SDPS Scheduler 1. Automatic and Manual Scheduling of Processing, Data Distribution - Automatic scheduling software - Manual scheduling procedures	Prototype planned for Radarsat upgrade. Manual time allocation. Manual production scheduling.	ADAPS AVHRR pass schedule is manually loaded into data base which is used to do antenna pointing to track the satellite as it passes overhead. Data is batched for down stream processing which is data availability driven. Weekend passes are captured on 3480s using tape stackers. Landsat Pathfinder Processing history collected - good case for PGS study. Real time AVHRR processing uses spacecraft schedule to schedule processing of signal data. Landsat MSS data was processed with EDIPS which had capability to accept data acquisition requests made by phone calls from users. Good procedural experience but a very manual process.	DADS has resource manager. **DADS has simple automatic scheduler.** **More powerful scheduler (kronos) planned.**	PGS for TOPEX/POSEIDON will track the schedules required for the products to be generated. MGDR uses manual schedules. Pathfinder will use an automated scheduler with manual override. An ftp site is being prepared.
2. Staging/De-staging of Ins/Outs - Software/Procedures for staging processing inputs and destaging processing products	?	Yes - custom	**Yes**	Incoming data is handled with product-specific tools and procedures. PGS scheduler includes I/O.
3. Task Initiation - Software/Procedures for initiating processing per a schedule	Manual, by operations.	Yes - AVHRR processes initiate tasks. DORRAN/PCS (Production Control System) has some potential here.	Planned	Manual
4. Communications w/ SMC	No	DORRAN/PCS relates to this somewhat	No	Status of PGS production, Pathfinder.
5. Communications w/ EDOS/Pacor	No	Kind of like EDC interface to EOSAT	No	No

	ASF	EDC	GSFC	JPL
6. Communications w/ FDF	No. ASF communicates with foreign flight agency to obtain ephemeris, send DARs, and receive schedules.	ephemeris from Navy Space Surveillance	No	Manual and automated file transfer, as required, from project offices (planned for NSCAT).
7. Processing Control Language - Scripting language tailored for running processing algorithms	Yes - DCL and UNIX scripts.	TAE and shell scripts	**UNIX and TCL scripts**	No
8. Publishing Production Schedules - Software/Procedures/Formats for publishing planned production schedules for the rest of the user community to persue	No	DORRAN has order status, scheduling is manual	No	Manual
9. Messages to Production Monitor Personnel - Messaging software, types of messages which have proven useful	Yes - both systems.	DORRAN used for this on the floor, thinking about adding a specific subsystem for this.	Planned	On-screen text messages to operators.
10. User Interface - Any kind of specialized user interface tailored to scheduling personnel	Yes - for operators only.	Yes - custom by product type	Yes (Internal staff interface)	No
11. Error Handling/Recovery - Software/Procedures for recovering from aborted product generation due to errors, crashes, etc.	Poor	Yes - console messages and other monitoring (e.g. Bit Error Rate detectors are monitored on tapes) Famous for recovery from bad HDT (High Density Tapes).	Yes, manual procedures. Plan to incorporate better error detection and tracing capability (e.g., flow through all s/w processes).	As provided by the operating system and the Pathfinder production system.
Information Search 1. Directory Search	Available to authorized users and guest account (search capability only). V0 compatibility in July, '94.	Yes - GLIS With Directory (summary), Guide (summary details) and Inventory (to granule level). 30 USGS data sets now available, cannot query across data sets for now, links are provided to about 8 other systems including GCMD, CCRS, Sinfonia, and PLDS.	Extending ESDIS GUI for local functionality. Supported by server to ESDIS IMS clients. **Data product searches supported in local CHUI.**	Supported by server to ESDIS IMS clients. The V0 IMS does the information searches, so everything in the "V0 System" column applies.

	ASF	EDC	GSFC	JPL
2. Inventory Search - Core metadata - Spatial queries - Complex queries (i.e., the use of "not", "and", or "or" in the query) - Dependent valids - Coincident search	Local ChUI with graphics extensions. Processed image inventory available for ordering on-line. Core Metadata = time, space, and spacecraft. Yes - spatial queries. Use binning algorithm (needs improvement). Complex queries - support queries on any combination of metadata parameters (approx. 40), either core or secondary. Can be very slow. No - dependent valids. Support coincident searches for SAR image sets only. Search presently limited to processed data only. May incorporate some NSIDC capabilities with V0 (i.e., spatial query).	Yes, (considered metadata search) Same as V0. No coincident search.	GUI & ChUI coincident, "brute force" query, user specifies primary data set, and secondary data sets that are compared against the primary . Will add coincident search to local GUI. **Core metada:** **dataset, data product,sensor, platform, parameter, lat/lon, begin/end date.** **Dependent valids in local CHUI, incl auto fill-in.** **Limited 'or's supported for specific parameters.** **Spatial queries:** **rectangular & quadrilateral search areas**	Subsets of data based on temporal and spatial criteria specified by the users (I think this refers to Subsetting below the data set level to data granules) - using ESDIS IMS client for GUI - core metadata inventoried by geo-reference and time, spatial queries same as ESDIS IMS, dependent valids as implemented by ESDIS IMS client - no complex queries or coincident search IOS is the DAAC Interval inventory system, which will have a DAAC-specific set of capabilities.
3. Guide Search	Current ACS has limited Guide functionality. Upgrades planned 7/94 through ESDIS IMS.	Yes GLIS	Yes. Not populated. Developed widget that interfaces with WWW and WAIS servers. (This is V0 system.) We will have it by default in our GUI. ChUI use**s** WWW	Will support ESDIS IMS guide effort. Uses V0 System.
4. Guide Development - Tools for creation of guide				None. Use V0 guide.

	ASF	EDC	GSFC	JPL
5. Reference Search - Algorithms, calibrations, etc.	On-line bibliography capability. Available but not populated.	Yes, part of the Guide Information	Yes - documentation. Some information on algorithms, calibrations, etc., provided in the guide	Algorithm, calibrations, etc., available in the guide inf.
6. Display Results - Coverage map - View details - Showing coincident results	Alpha-numeric tables and coverage map through graphics extensions.	Coverage map provided in XGLIS coverage. Does everything V0 can do.	Yes (coverage map, view details, coincident results is planned). coverage map is same as ESDIS IMS. View details is same as ESDIS IMS. Sort by date and time like ESDIS IMS. Cross-DAAC mode of GUI is the same as ESDIS, but local mode will have local functionality.	View details is same as ESDIS IMS Sort by date and time like ESDIS IMS Coverage maps off-line (hardcopy) for MGDR. (Assuming here that this relates to Browse products.)
7. Data Set Specific Search Parameters - Search on attributes related to a specific data set (i.e., path row)	Yes - SAR images have common metadata, upper level products have own metadata. All metadata fields are searchable and reportable.	Yes - AVHRR has 15 parameters, MSS has 17, TM has 19 ... only 4 or 5 of these are common parameters.	Yes, if required by science project.	Yes, a local, non-IMS capability. Available in the IOS, the local version of IMS.
8. Data Set Specific Results	Yes.	Yes	**Yes, dataset specific attributes supported.**	Yes, part of previous local capability. The IOS is the interface seen by the DAAC users.
9. ADC/ODC Inventory Interoperability	Interoperability with CSA. Radarsat catalog in V1 timeframe. ASF gets Greenwich Hour Angles from JPL via FTP.	Yes - Landsat & AVHRR data sets can be accessed even though not transitioning to ECS (where ADC is the DAAC itself) Level 1 (to the front door of the data centers IMS) interoperability to 8 other systems.	No	No
10. Design Documents - Edits have the ability to search design documents in general	No.	Yes - hypertext for developers, but not through the IMS yet. Some image display software distributed on CD ROMs.	Yes. Some high level, **online, hypertext, for internal consumption**	Paper and electronic copies available.

	ASF	EDC	GSFC	JPL
11. Browse - Ability to query browse data - Ability to display browse data	Hardcopy prints of image.. Looking at degraded SAR to support V0 browse.		Yes - Distributed software as a product to user workstation; user can order product from local browse s/w; map overlay; overlay granule coverage on browse image. Provides ability to browse and order data even when not attached to search & results process. Will display multiple images from one file. Mapping between browse granule and corresponding data granule gives product request re-using ESDIS server. Yes, if generated by science projects.	Same as ESDIS IMS Will include a browse mechanism which supports multi-image HDF browse files. Will be called "browse viewer". The same files will be used with FrameViewer and by the V0 guide in HTML. The Browse data will be on CD-ROM.
Archival Product Requests 1. Product Requests - Product orders - Media/Electronic - Spatial/Parameter subsetting - Standing orders	Placed by users or ops. staff in case of error recovery. Due 7/94 through ESDIS IMS. Current system allows product requests for processed data. FY'94 adding product request from raw signal data.	Standing order capability. Every order is verified via phone call to requester. (assume generation request here) implied in order, special products produced for cooperative agencies, many orders for level 1	ChUI manual **standing** order database. FTP held for 3 days. (minimum) **Spatial and parameter subsetting planned**	Limited. Automated on-line ordering system will be open to UWG and selected members of the scientific community. Use V0 IMS. Now done by phone/e-mail with User Support Office.
2. ADC/ODC Product Orders	Manual or through V0 System IMS.	EOSAT=ODC (where EOSAT TM metadata is stored at EDC mixed with EDC TM metadata) SPOT=ODC ESA exchange of AVHRR 1km data is another ODC example. Through V0 System IMS.	None other than own holdings. Through V0 System IMS.	None other than own holdings. Through V0 System IMS.
3. ADC/ODC Browse	No	Not image browse but metadata browse, EOSAT CORE can support image browse.		None other than own holdings.

	ASF	EDC	GSFC	JPL
4. Distribution Authentication - Checking authorized users for restricted data sets (How?, Custom or COTS?)	Verified when order is placed.	All orders have personal call to authenticate	Yes. Not automatic. Semi-automated data security, data authentication **(custom)**	Yes, through User Support Office (USO). Some ERS data is proprietary. There is a TOPEX verification period.
5. Order History (i.e., What is tracked per order? Stored in DBMS? Available reports? How long is it kept?)	Yes - Lists of images ordered and by whom.	Yes, DORRAN is very complete, data is archived forever, customer satisfaction surveys are taken with cards sent out with the orders.	Yes **Status, dates tracked in RDMS** **Routine and custom reports kept some months then "archived" to separate table.**	Yes, manually through user profiles and DOTS. Summary reports are generated through DOTS.
Processing Request Services				
1. Ancillary Data Sets for Processing (i.e., stored, displayed, queried)	Not currently distributed (time correl. elements, ephemeris, wind and temp. data) (UNIdata)	Yes - Ephemeris, DEMs Ground Control Points (GCP), Digital Line Graphs (DLG)	AVHRR processing	JPL will archive ancillary data for reprocessing of EOS ALT and SeaWinds, TOPEX, NSCAT, etc.. No automated methods.
2. Ancillary/Aux. Data Limits Checking & Pre-processing - QA of ancillary data - Reformatting - Regridding	Yes	Assume all data provided from other sources has been QA'ed but have many examples of errors. NLAPS does gross limit checking.	No	No Flight project people have the responsibility for ancillary data reliability.
3. Level 0 Data Validation - "Generic" validation of Level 0 data prior to processing	Yes	Visual QA of Landsat as big backlog is reprocessed from HDT to archive (NLAPS and TMACS) but not every scene is checked - just a sample is. All of MSS was checked. Assume QA for TM from EOSAT is correct.	No (no level zero data)	No level 0 data at this time. But this would not be performed by request; checks done upon data receipt. MGDR validated at Level 2. Pathfinder data at Level 1B.
4. Processing - Standing order product processing - On-demand product processing - Changes to standing orders - Priority processing requests - Quick-look processing - Reprocessing - Recovery procedures	No - standing order, changes to standing order Yes - on-demand, quick-look, reprocessing Priority proc. - yes, but with greatest reluctance Recovery procedure - too many manual recovery procedures -- tools needed!	Yes. Quick-look processing has been done in isolated cases for AVHRR.	Standing order and on-demand capability. On-line order capability is limited by data sets that have currently been ingested.	Customer processing to be performed based upon user request. Spatial and temporal subsetting for some data sets. Pathfinder has planned capability.

	ASF	EDC	GSFC	JPL
5. Metadata Creation/Uploading/Updating - Creation of inventory metadata during processing - Uploading of metadata to IMS - Updating of existing metadata (e.g., updating of QA flags after manual QA)	Yes	Yes, examples of automated metadata creation where data is taken from headers upon ingest and where tape IDs are changed.	Yes Data ingest **extracts** metadata & sends to IMS.	PGS will provide metadata.
6. Product QA	Visual Inspection Manual QA of GPS (Geophysical Processor System) data. Maintain SAR calibration arrays in the field SAR processor validation SAR inter processor calibration Planned to coordinate cross-calibration of ERS-1 and ERS-2 Media QA performed	Yes - metadata is an active interface, QA flag can be updated. Random sample of tape products are read to make sure they are readable, custom products are closer checked, all photos are QA'ed.	Yes - limited Manual QA of TOVS Pathfinder level 3 data. AVHRR products are quality checked. A commercial image processing package is used for some checking (EASI PACE).	For Pathfinder and the MGDR, JPL will provide quality control of data sets that are generated. Data flags alert user to special conditions. QA checks software.
7. Processing Tracking, Logging, Reporting	Primarily manual now - some database support available. Additional tools required.	Yes - AVHRR data flow good but may not automatically collect/store much history but best example is an SCF supported by EDC for Landsat Pathfinder. NLAPS collects processing history and the history is part of the product.	Yes - More planned IMS and DADS log improvements have currently been recommended. Master Scheduler keeps track at the order number level, but this order number is not flowed through the individual routines. This is one of the planned improvements.	Yes, a QA report.
8. Collection of Mgt. Data - Fault detection and reporting	Very little error processing in the current system.	Yes - time to complete order - other "marketing" information also collected.	**Operator alerts** Planned	Manual record keeping.

	ASF	EDC	GSFC	JPL
9. Multi-DAAC Orders - Data obtained from more than 1 DAAC to be used in product generation or to satisfy a user request	Only 1 DADS - manual coordinated User Services	JPL, AMES, STENIS For example, EOSAT sends data to EDC to mix with EDC based data to complete order; SPOT data is distributed by EDC. EDC acts as a broker for others. A mechanism was developed to pass order requests from the IMS to JPL for product generation of AVIRIS data sets. (1994) The definition, development and implementation of software, procedures and associated user documentation to facilitate the distribution of raw and higher level products to the science community in HDF or other acceptable format on a variety of media or via electronic networks.	**No**	No

	ASF	EDC	GSFC	JPL
Manage Storage System Service 1. Send Distribution/Staging Status - Manual override of distribution priorities - Tracking/reporting Distribution Status and history - Distribution status provided upon request - Verify/check distribution correctness	Operator control of priorities. User status inf. cryptic but available on-line.	In the areas of archive management, order processing, and distribution functions, the DAAC is able to utilize existing EDC systems and operational flows with little or no modifications. Emphasis on history, tracking, metadata and browse going into the EDC production database system. DORRAN keeps records forever. As data is ingested, metadata is created and stored in DORRAN. Ext. users cannot access DORRAN, user support services access the sys. in response to user requests. DORRAN scene hit list printout are sent to users who pick what they want from the list.	Much automation planned, cost estimation. User services interface is the same as "Staff Tools" Automated verify user request correctly translated; manual check by operators; automated sample of 3% of distribution tape media. Automated sampling of VHS tapes planned. **User correspondence tracking.**	Statistical information maintained, distribution requests tracked. Selected samples report; statistical information maintained in Ingres database. Handled via DOTS.

	ASF	EDC	GSFC	JPL
1. Send Distribution/Staging Status (continued)		DORRAN computes cost to user from the user order. User Services checks w/ user to see if they still want order after cost is computed. Credit card or cash in account at EDC required before order is processed for non-govt. orders. DORRAN generates prod. production instr. to production staff and prints labels for mailing out prod. orders. DORRAN has a complete accouting sys. that interfaces electronically to many govt. agencies; it uploads billing to these agencies. 6 indep. copies of DORRAN are running at various USGS sites that can talk to each other. DORRAN can handle the gambit of accounting problems incl. Gov. regulations, refunds, ... Manual, call customer service.		
2. Report on Resource Conflicts - Take corrective measures when network performance impacts distribution - Manage contention for storage system resources	No	UNITREE handles some of this, tape drive contention occurs, Operating System handles alerts.	Current resource information is being collected, however, there are no defined user reports.	Site fault detection and correction
3. Manage Element Resource Utilization - Alternate between tape units to minimize overuse of any one tape unit	Tricks with wires and mirrors (i.e., manual)	Manual planning activity prioritizes the addition and allocation of resources such as disk and tape units.	Yes Resource manager **UniTree uses tape drives in defined order, which can be adjusted to avoid overuse.**	

	ASF	EDC	GSFC	JPL
4. Generate Accounting Inf. for Distributed Data - Generate distribution reports - Cost and billing information	Yes	Yes, for file transfers, for the silo and performance status on the EPOCH, networking status.	No billing is involved, but user order information is tracked in an Oracle database. The Staff Interface is used to generate reports.	JPL maintains a user database to document the data ordering cycle and support data distribution; system also supports generation of user statistics. No billing is performed.
5. Monitor Status of Storage Systems - Performance	Manual	Yes	Planned - GUI displays for status, performance monitoring	Manual monitoring, no formalized parameters.
6. Collect Storage System's Operating Statistics - Performance - Security - Fault	Yes for ACS (I/O, memory-performance stats), otherwise, manual - more needed	Yes, using operating system account utilities	Planned	System usage report, user processing statistics kept in Ingres database This is not automated.
7. Storage System's Operator HMI	Yes - menu-driven - GPS, ACS ChUI Simple QA and lists on processor.	Yes - custom by system and data type based on generic code library (ADAPS) where AVHRR is the model. ChUI interface to archive database.	Yes **command line only.** **Storage system almost completely automated.**	Yes Vendor supplied (i.e., Metrum)
Toolkit Services 1. PGS Toolkit - File I/O tools - Error/status reporting tools - Process control tools - Ancillary data access and manipulation tools - Time and date conversion tools - Math and modeling support tools - Constants and unit conversion tools - Graphics support tools - I&T support - Platform data simulation tools (ephemeris)	None used now. In Radarsat, plan to use PGS toolkit.	LAS is main tool and public domain software. Geolocation and terrain correction software. ARC - Inf. custom routines, PVWAVE, Image Display Language (IDL). TAE much reuse LAS and ADAPS.	AVHRR transition**ed** to the DAAC. AVHRR processing s/w includes time conversions, sun vector computations, satellite position and velocity computations, sensor orientation from orbit position, and others. Refer to the AVHRR description documentation.	PO.DAAC has no tools to contribute to others for V1. DAAC uses some COTS, IDL visualization tool.
2. IMS Toolkit - IMS server API for update, query, DBA utilities	None now.	IMDIS software from Goddard includes on some CD ROMs.		ESDIS capability.

	ASF	EDC	GSFC	JPL
3. Data Visualization - 2D & 3D plots - Earth coordinate cursor - Contour plots - 3D surfaces - Image manipulation		Builder Xccessory used to build IMS window templates.	Image zoom by 1994	Browse, IDL, NCSA
4. Geographic and Geophysical Overlays (i.e., embedded in data or visualized at runtime?)	?	Yes - Geographic overlay for showing data coverage in XGLIS.	**Yes, if info is included** in the products.	No, unless embedded in the products. For Pathfinder, uses a hand mask.
5. Production Management Toolkit	Will be developed for Radarsat			
Communication Services 1. Bulletin Board	Yes, but poorly designed.	Kind of in GLIS - one way, ADP INFO is used for EDC internal status (one way interface).	News Service within IMS. **Dataset comments submit and view within IMS**	Update of PO.DAAC.DATA bulletin board on OMNE. Quick-Look Bulletin Board for TOPEX/Poseidon data.
2. User Feedback - Facility for user to enter comments - Facility to ask questions of user about tools	Feedback to user via e-mail as instruction warrants.	Yes at any screen in GLIS, forms with distributed data, THIS NEEDS TO BE REPLICATED IN ECS	Yes - submit and view comments from others on data set and/or DAAC.	Done through User Support Office.
Distribution Service 1. Distribution Media	8mm, photo products, 9 trk, CD ROM sampler in production 4mm and electronic FTP planned	8mm, 4mm, 9 trk, 3480 tapes, FTP, film (b/w & color), CD-ROM (1994) electronic networks, transparencies, CALCOMP and photo-like plots. 4mm capability exists but is used for a custom interface and is generally not available to everyone	9 track, 8mm, 4mm, CD ROM, FTP. Floppy's, hard copy, 3480 cartridge, VHS tapes. Manual shipment of physical media. No automatic labeling.	8mm, anonymous FTP, 4 mm, CD-ROM, FTP 9 track, 3480 cartridge, 5 1/4" floppy, 3 1/2" floppy, QLBB.

	ASF	EDC	GSFC	JPL
2. Distribution Formats - Format conversions - Quick-look products	CEOS current, HDF planned Level 0 are identical to standard product in format.	Native COES - no HDF data sets but some (Aircraft Scanner) HDF browse (1994) The definition, development and implementation of software, procedures and associated user documentation to facilitate the distribution of raw and higher level products to the science community in HDF or other acceptable format on a variety of media or via electronic networks for AVHRR 1KM 10 day composite and related orbital stitch data sets.	No - Distributed in current format. UNIX compression distribution option.	HDF, plus native formats: AVHRR Oceans Pathfinder to be in 9 km gridded fields in HDF QLBB permits access to IGDR in near real-time by the SWT. Native, HDF, CDF, netCDF, determined by PO.DAAC UWG; Extract regional data products from global HDF fields of MCSST and AVHRR Oceans Pathfinder; some data sets converted to HDF (SSM/I, CZCS, AVHRR Oceans Pathfinder, AVHRR). Quick-look bulletin board
3. Prioritized Distribution - Process data transfer delay or cancellation	Yes, manual	Yes	No	The Project SWT is highest priority during verification period. Flight Project priorities on data distribution (TOPEX/Poseidon, NSCAT, ERS-1/2) are met before other data sets.

	ASF	EDC	GSFC	JPL
4. Browse Storage - Browse archive characteristics	Hardcopy prints available	Yes - AVHRR browse is on line (JPEG compressed), TM & MSS is on tape for now, Aircraft scanner is on line in the EPOCH. Aircraft scanner is stored in HDF in 24 bit but is dithered to 8 bit in real time as it is sent to the V0 client. Browse stored in native and converted to HDF on way to V0 IMS, some browse for data sets that will transition to ECS stored in HDF, 4 data sets have no browse. AVHRR browse stored JPEG compressed.	Currently, browse images exist only for AVHRR Pathfinder data. They are being compressed using UNIX compress, which is the GDAAC standard compression tool. Images are reduced from 344K to 90K (just < a factor of 4). GDAAC anticipates browse images for 2 other data sets in the future, TOVS and SeaWiFS. The content of these future browse products is still TBD, thus it has not yet been determined if they will be compressed or what the factor will be. The one certainty is that if they are compressed, it will be the std UNIX compression tool.	Stored on-line and on CD ROM.
5. Subsetting/Subsampling	No	Yes - much work on this, advanced concepts considered good ideas for ECS prototyping. This is data set dependent.	Developed AVHRR land continental Sub setting software for distribution. Will have HDF parameter subsetting.. Will have geographic subsetting for global products. **Automatic subsetting planned**	Software will be developed to extract regional data products on demand from global HDF formatted fields in support of the distribution of the MCSST data set and of the AVHRR Oceans pathfinder data set. Fill Order performs subsetting (time, location), gridding

	ASF	EDC	GSFC	JPL
6. Push vs. Pull of Data Distributed to Users		Today, hard copy (film, tapes,...) data is sent to users if payment is in place. No electronic shipment in place today but soon users can pick up data via anonymous ftp account. Users will be notified by e-mail of data availability.	User notified. FTP file transfer by users; deletion from distribution areas based on time and disk space regs.	Push vs. pull, data staged locally, user notified, data deleted after 72 hr. For all FTP's, user pulls the data.
7. Read Software	Yes - CEOS Reader and SCF tools	Data set specific	**Yes**	Read software available and specific to each product.
Application Program Interface (API) Services 1. Local User I/F	No	No API	No	No
2. Metadata Searching	Currently planned for Radarsat.	No API	No	No
3. Guide	No	No API	No	Nothing now. Plan to use ESDIS.
4. Archive API	No	No	No	No
Data Acquisition Requests 1. Orbital Model Display - IMS portion of DARs - DAR submission	Submits DARs to foreign flight agc. for scheduling. In future, geographic display available via user interface.	Old MSS system had standing acquisition requests and customer services reported back to flight ops., an AVHRR project had a say as to what scenes would be saved on the LAC recorder and DOD has called in requesting EDC to advise NOAA, not part of GLIS.	**No**	None
Statistical Collection for LSM 1. Monitor IMS Usage (i.e., what statistics are kept and how are they implemented?)	Yes - manual and limited automated	Yes - GLIS	**Log files with log-reader.** Statistics are kept in an Oracle database, with limited reporting capability. Additional statistics are still required.	Collect statistics on Browse and Order requests using DOTS (Data Order and Tracking System)
2. User Access Patterns (i.e., what and how?)	Limited available - need more	Maybe not to individual user. Could be done but USGS policy prohibits this for client confidentiality.	Monitor media, type of access, who ordered what data sets. **Usage tracking planned.**	Software will be generated to capture user statistics from FTP transfers, and to transfer them to the DOTS,

	ASF	EDC	GSFC	JPL
Ingest Service 1. Basic Electronic & Tape Ingest - 8mm - 6250 bpi - CD ROM	Don't ingest from outside now. With Radarsat, planned to ingest foreign station signal data and associated metadata.	Data set dependent: 4mm (one case), 8mm, 9-trk 6250 bpi, 3480 cartridges, CD-ROM, HDT Electronic: Procedures were developed and tested to support the transfer of AVHRR HRPT and LAC data to and from the NSIDC DAAC via the Version 0 DAAC-to-DAAC network. It is estimated that data transfers would involve approximately 600 MB of data daily.	Yes 9-track tape, 4mm tape, 8mm tape, 3480 tape, CD-ROM Use client server data transfer program for electronic transfers.	9-track, CD-ROM, electronic file transfer, 3480 cartridge, 8mm cartridge, hard copy, 4mm DAT, Sony optical disk, floppy
2. Media Formats - Tar, backup, ...	N/A	TAR, backup - not for ingest, prefers ANSII labeled tapes, HDT is CCSDS telemetry scheme, many custom tape I/O device drivers	Yes (TAR) Use COTS to translate from VAX/VMS to UNIX; tar; magnetic tape archive.	UNIX unlabeled tapes, and VAX labeled and unlabeled tapes, tar tapes
3. Data Checking - Media readability - Checksum - Check format - Check data ranges	N/A	Yes, data set dependent	QA software for TOVS Pathfinder L3. Checksum built-in processing sequence. Automated check user request; Operations personnel check. QC software used in AVHRR post processing (EASI PACE)	Various quality assessment checks; check media readability, check data format; product QA provided by PGS, DADS QA

	ASF	EDC	GSFC	JPL
4. Receive HDF & Native Formats, Format Conversions	N/A	Yes, native.	Yes Translate UARS L3A to HDF Vset. HDF conversion software for TOVS Pathfinder. TOMS2 L3 translation to HDF. CAC-SST, TOMS2, GridTOMS, UARS, AVHRR Land Pathfinder, SeaWiFs ingest. AVHRR L1B (p), TOVS processing(p), TOGA-COARE(p), AVHRR/Pathfinder Atmosphere & ancillary data ingest. TOVS/pathfinder ingest (L3, L1b). Meteor3/TOMS2 ingest (L3). 15 yrs. TOMS conversion to HDF. CZCS ingest L1, 1a, 2, 3.	MCSST/CZCS CD-ROM; ERS-1, ERS-2, NSCAT, TOGA CD-ROM, SSM/I Oceans products, altimetric CD-ROM, TOPEX/POSEIDON, AVHRR Oceans Pathfinder, SeaWinds; Data format standards task. Read & display software for all data sets. Some enhancements of levels of service. Ingest of ERS-1 low bit rate data into a private archive. Ingest of TOPEX/POSEIDON, AVHRR Oceans Pathfinder into public archive. Ingest Level 0 through level 4 algorithms, ancillary data, metadata, data, and correlative data. On ingest, data quality and completeness will be verified.

	ASF	EDC	GSFC	JPL
5. Data Compression Techniques	N/A With the exception of one Level 2 product compressed with run length encoding (RLE), no compression in being used.	No compression is done on standard products. For browse, some advanced work (e.g., AVRIS compression study) EDC has also been testing the recent incorporation of JPEG compression capabilities in HDF and investigating their possible implementation in AVHRR browse delivery to the IMS. Today, V0 IMS AVHRR browse data is JPEG compressed on WORM drive. For V0 IMS the browse is decompressed, converted to raster, put into HDF and shipped to the user. In the future, the raster will be compressed and sent out in HDF to user for V0 IMS client to decompress. For GLIS, the browse is sent compressed to the client on the users machine where the client uncompressed it.	Standard UNIX. Study of software compression techniques. Currently all AVHRR is compressed before archive and distributed in compressed form. UARS is always not compressed. AVHRR Pathfinder data is being compressed using standard UNIX compression. In general, data is distributed as archived.	No. HDF.
6. Metadata Generation on Ingest - File location or file identification - QA status	N/A	Yes - QA flag not from an Expert System but following technology to do this someday.	Yes - some data	Generates inventory entry on ingest of TOPEX/Poseidon QA, pathfinder, MGDR. Difference from core V0 metadata attributes - TBD
7. Receive Metadata, L0-L4 Data Products, Instrument Data - Schedules - Status	N/A	Yes	Yes	Yes, to all.
8. Scan Hardcopy for Ingest - Data or documents	N/A	Yes, digitize maps to make Ground Control Points.	No	Planned
9. Request Re-transmission of Missing Data	N/A	Yes, manual (AVHRR and MSS)	Requests all	Yes, automated for TOPEX/Poseidon IGDR/GDR, AVISO/CNES GDR.

	ASF	EDC	GSFC	JPL
10. Push vs. Pull of Received Data	N/A	Both; stage data for NSIDC pull, receiving pushed data, doubt pushing data to external interface except for V0 experiment	Push, using client/server file transfer software.	Data ingested under submission package worked out with project. Presently, the data is pulled in.
Archive Service 1. Import & Export Physical Data - Manual or automatic remove/add of media to archive) - Recover data from failed devices and media	Receive Level 0 data directly from softcopy to a HDDT (DCRSi)	Yes.	Yes, for CD ROM. Planned for Metrum tapes and ATG WORM platters.	Manual
2. Automatic Copying/Refreshing of Media - Manage media degradation	2 original copies made on signal acquisition - if working copy goes bad, new one copied from archive.	Semi-automated process. Previously, tapes were mounted and are monitored manually. The schedule for refresh to media was manually scheduled based upon media life expectancy. Now specific BERT testing is done on DCRSi data.	Error detection and correction code for optical disks and VHS tapes.	Planned. Manual at present.

	ASF	EDC	GSFC	JPL
3. Integrated FSMS to Manage Archive	No	STK SILO/UNITREE and EPOCH EPOCH's FSMS, not for off-line data. The archive storage for these data sets are in environmentally controlled space, access control system security etc. and has a UNIX based relational database tape archive inventory management system to provide inventory control and report writing capabilities. The tape archive inventory management system contains no science metadata. This system contains archive housekeeping information concerning storage location and media health.	Yes - UniTree has been enhanced to support asynchronous I/O to take advantage of multiple CPUs and to improve performance for simultaneous archive and distribution.	Maintain according to NARA/NIST, configuration control of data sets. Off-line inventory. Metrum mass storage device.
4. Verify Data is Present & Accounted for	Yes - manually - need tools	Yes - manual	Yes	Yes It is manual, with Metrum/Unitree to be implemented.
5. Deletion of Archive Data	Bad images hidden in catalog - available in archive.	Data is not deleted but a scheme exists to mark data as not available.	Replacement policy is planned	Upon scientist/UWG approval

	ASF	EDC	GSFC	JPL
6. Data Archive Integrity Check	Manual checks	Yes, Bit Error Rate testing. On the DCRSi cassettes EDC is writing 3 BERT patterns at beginning, middle, and end of tape. After tape is complete, EDC reads the error patterns and collects the min., max., and med. error rates; this data is saved into a file for future ref.. The file is checked when the tapes are played back. EDC ensures that tapes are w/in a min. req. and EDC is looking for long-term changes to give clues when media migration must start. The tape library also has a few cassettes that have known patterns that are read for tests periodically to see how many times a tape can read before it fails. EDC has done this once a week for a year and has not seen any degradation yet.	Manual	Yes, manual.
7. Backup for EOS Data - On-site - Off-site	No	No, two copy process where master tape stored and working copy used in distribution for popular data sets	No. Off-line archive. Backup of L1 is provided at data producer site. Full archive backup planned.	One copy in mass storage device and a second copy maintained in deep archive
8. Restore Archive	Yes - for individual tapes (manual), optical archive may require reprocessing to restore.	Have assisted others. Parts of many of the data sets are duplicated at other sites.	Backup copies planned	Yes

	ASF	EDC	GSFC	JPL
9. Capacity to Ingest 3x Normal Ingest Volume in 1 Day	No	Real time sys. are sized to handle slightly more than 100% max. downlink - no req. to handle 3x volume. Data spools to tape and there are enough time slots to catch up w/ backlog as well as to accept data on tape from other sites. Backlog on AVHRR data from ext. sites is substantial but processing is sized to meet users needs. Sys. are augmented for more capacity if user demand warrants it.	**10x ingest rate planned for SeaWiFS**	Archived based upon project requirements (e.g., archive 10 days of TOPEX data in 1 day). Not for Pathfinder.
10. Monitor Bit Error Rate (BER)	Yes, for raw and Level 1 data	Yes	No	FTP BER for data transmission.
11. Stored Data Format - HDF - Native - Some other format	Varies as a function of data set. CEOS for image data, machine dependent for signal data, pseudo-CEOS for GPS	Native ANSII labeled 3480 is the standard but data set dependent. Production metadata is kept with the browse record.	**As received (HDF or Native)**	Determined by PO.DAAC UWG, HDF Native DSP.
12. Monitor Archive Performance	Yes, mostly manual	Yes - manual	Planned	Provide quarterly report
13. Prioritized Data Retrieval - Browse, quick-look, standard products assigned different priorities	Yes, user driven	Yes - manual	**Yes, browse kept on mag disk.**	Yes - done manually
14. Track Access to Specific Data Granules	Yes - better tools needed	No	**Yes, report capability planned.**	Done via ordering system.
15. Archive Hardware	DCRSi tape drives	High Density Tape recorder (old system), 3480 is current standard, 9 track tape, DCRSI, STK Silo and EPOCH jukebox	Cygnet 1803 12" Optical WORM jukebox (1179 GB); Metrum RSS600b VHS Automated Cartridge System (ACS) (8700 GB), SGI 4D/440S 26 9 GB mag disks magnetic tape (p).	Data Storage controller, controlled by SGI. HSC 50 8 GB 16 Disk drives DEC type RA81 Metrum

	ASF	EDC	GSFC	JPL
CSMS				
Communications Network Infrastructure 1. Network Components - Gateways (X.400/SMTP) - Routers - Hubs - Circuits (site-to-site, i.e., including DAACs and selected ADCs and SCFs) - Dial-up access	Via Internet and SPAN. 1200 & 2400 Baud dial -up T1 link shared by mission success and mission critical networks Ethernet LAN 1 cisco router 256 kbps link to JPL	Yes 2 cisco routers (primary Ags +, backup IGS) Ethernet LAN 256 kbps link to MSFC 5 WANS: DAAC-DAAC, NSFNET (T1), NSINET(T1), GEONET II (2 T1s), BANYAN VINES to USGS. EDC is Part of MAGIC which is a DARPA-funded testbed with a T3 going to 1Gb bandwidth.	Gateways (x.400?), routers, hubs(?). 2 cisco routers (primary Ags +, backup IGS), 168 kbps link to JPL, 504 kbps link to MSFC, 168 kbps link to LaRC, T1 link to NOAA, FDDI LAN, Ethernet LAN	2 cisco routers (primary Ags +, backup IGS) 256 kbps link to ASF 256 kbps link to NSIDC 168 kbps link to GSFC 168 kbps link to MSFC Internet Omnet Ethernet FDDI internal and external. Planned link to NASDA @ T1 bandwidth.
2. Network Management - Security - Performance - Network monitoring - Performance tuning & analysis (file transfer timing) - Browse applications time	Stuck with Internet Performance router managed by V0 NOC at GSFC	SNMP workstation being acquired, SUN NETMASTER routers managed by V0 NOC at GSFC data transfer performance testing with host machine at MSFC DAAC and the Sun machine at EDC	Routers managed by V0 NOC at GSFC	Routers managed by V0 NOC at GSFC. FDDI and Ethernet ILAN managed by JPL Security.

	ASF	EDC	GSFC	JPL
3. Basic Communications Services - Directory (e.g., DNS, X.500) - Data compression - Network security (authentication, authorization, address filtering, sub-network isolation (e.g., FOS LANs), card key security for remote ISTs) - Session (GUI type) - Xterminal support - Remote terminal support - File transfer support - Interprocess communication - Time synchronization support - E-mail - Remote data (distributed file system, DBMS client/server) - Remote process invocation - Bulletin board	FTP, Internet for e-mail, Telnet Yes - remote terminal support No - Xterm support, interprocess communication, remote data, remote process invocation No time synchronization - planned for Radarsat	Data compression, authorization, Xterminal support, remote terminal, file transfer, e-mail, DBMS - yes. Inter-process comm. Support data transfer to and from NSIDC via V0 network (up to 600MB of data daily) FTP, Telnet e-mail (SMTP) Data compression Browse delivery to IMS TCP/IP EDC product distribution system (initially staging data for FTP pickup) GUI enhancement, design and development	Directory, data compression, network security, authentication, authorization, session, Xterminal support, remote terminal support, file transfer support, e-mail, DBMS FTP, Telnet, client/server, e-mail (SMTP). Automated network data transfer. Current data ingest load is 12 GB/day, 1.5 GB/hr. Evaluated losses data compression techniques: recommendation is UNIX compress, GUI: Motif/X	FTP, Telnet, Internet, Sneakernet.
4. Protocol Suites - TCP/IP, GOSIP, DECNet	TCP/IP, DECNet	TCP/IP - yes GOSIP- doubt DG's are GOSIP compatible. BANYON/VINES, DECNET, some Apple Talk	TCP/IP DECNet currently available, but will not be part of official DAAC.	TCP/IP, DECNet
Local Site Management 1. Fault Management - Alarm processing/display - Vendor diagnostics - Event logging and analysis - Expert-system analysis	Manual troubleshooting	Yes - to all examples PC Based version now. SNMP workstation being acquired, SUN NETMASTER	Yes DADS and IMS logs available. Need additions to improve usability.	Yes, SGI Tools.
2. Network Configuration Management - Resource, logistics, policy & proc., maintenance, and inventory management - Software distribution (incl. toolkits) - Event logging and analysis	Inventory and maintenance management done manually	Policy based system, not dynamic, have hot backups on critical systems.	Yes	Yes, SGI Tools.

	ASF	EDC	GSFC	JPL
3. Acct./Accountability Management (Including billing systems) - OS account-data extraction - Event logging and analysis - Production/data status tracking	No for network. Weekly meeting held to review production Product order scheduling tracking and delivery 3 kinds of ASF users ESA - data credits NASA - data credits NASA - $ Further write-up	Yes - DORRAN system Refunds Assimilate changes in Gov. reg. Proof of sale to treasury Automatic upload of billing to other agency systems. Also system accounting, login tracking, system utilization tracking.	No billing is involved, but user order information is tracked in an Oracle database. The Staff Interface is used to generate reports. **Key staff actions in order filling are logged.**	Yes, DOTS (no billing).
4. Security Management - Event logging and analysis - Limited key management - Virus checks - Key mgmt. for private e-mail	No - Key mgmt., virus checks Event logging and audit trails done by operating system CERT (Computer Emergency Response Team) guidelines are used	Yes - Event logging, analysis of event logs, logs FTPs, but not telnets, logs 3 or more attempts to login, limited key mgt., virus checks.		Yes, JPL Network Security.
5. Performance Management - Event logging and analysis - Logging application perf. - Trending and stat. analysis - Load balancing	Network - none, better tools required for Santa VAX, basic performance parameters extracted daily with weekly summaries.	Yes - Event logging, analysis of event logging, logging appl. perf., trending & stats. analysis	Yes, on variable intervals dictated by current activities. Performance data is logged, but there is generally no reporting or analysis, except on as needed basis. Reporting capabilities are limited.	Yes, Event logging, FTP log.
6. Report Generation - Analysis of event logs - 4GL reports	Very limited for network, production data, data distribution, user support stats, USWG stats, intra-subsystem comparison reports. Better tools needed.	Yes - Analysis of event logs	Yes	Yes, DOTS.
7. Scheduling - Timeline creation/display	Data acquisition timeline created on-site, sent to FFA for inclusion, conflict analysis and resolution, schedule data acquisition, schedule processing of signal data	Manual, not in network sense, some queuing capability for batch jobs needing the CALCOMP plotter.	No	Yes

	ASF	EDC	GSFC	JPL
8. Servers and Workstations - Directory/e-mail/security servers for users - Directory/e-mail/security servers for computers - Directory/e-mail/security servers for applications - Local system management workstation	VAX 8530 (Santa) VAX 4000-90 (2) Sun 4 (UNIX) - GPS Sparc 2 (calibration station) Sun 4 (UNIX) - IIAS Masscomp - SPS HP9000 (2), RmBasic - RGS	Yes - servers for users, computers, servers for applications, PC workstation now for network IMS server. Sun workstation (host for network testing)	**SGI 40/440 VGX - IMS** **SGI 40/440 - DADS**	Yes, IMS will be hosted on an SGI machine.
Non-Local System Management 1. Scheduling - Multi-site schedule monitoring - Cross-site schedule coordination and adjudication	No	No	**No**	V0 Net Management.
2. Fault Management - Cross-site data aggregation - Alarm processing/display - Vendor diagnostics - Event logging and analysis - Expert-system analysis	Minimal, manual	Yes - network information centers interact with EDC routers.	**No**	N/A
3. Network Configuration Management - Cross-site data aggregation - Training, resource, logistics, policy & proc., maintenance, and inventory management - Enhancement rqmt. processing - User feedback processing - Source code control system - Event logging and analysis	No	Policy based.	?	N/A

	ASF	EDC	GSFC	JPL
4. Acct./Accountability Management - ECS-wide status tracking - Product pricing and user billing - Accounts payable/receivable - Transaction proc. - OS account-data extraction - Production/data status tracking - Event logging and analysis	No, for network No - transaction proc. Yes - Prod. pricing, Accounts payable/receivable - manual, Prod./data status - lots, manual, need more, Event logging - need better tools	No, on the WAN.	?	N/A
5. Security Management - Key management - Event logging and analysis - Virus checks	No	Yes Firewall - Monitor password tries	?	N/A
6. Performance Management - End-to-End network - Event logging and analysis - Logging appl. performance - Trending and stat. analysis - Load balancing	No	Yes - Can get data from GEONET, Sprint, NSF, NSI - the controlling entity does the monitoring. BANYON VINES has internal monitor.	?	N/A
7. Directory Information - User identification - Facility and equip. id - Data identification - User registration information	No, for network No - Facility id Yes, User id - have accounts, Data id - users restricted to certain data sets...manual, User reg. - manual	Yes - BANYON VINES has name list. Not X400 or X500 type of stuff.		N/A
8. Report Generation - System-wide analysis of event logs - Cross-site 4GL reports	No - system-wide, 4GL	Yes - Can pull down their reports	?	N/A
9. Network Help Desk	No network help desk, but do have a user help desk.	Yes - Network operations centers		N/A

	ASF	EDC	GSFC	JPL
10. Servers and Workstations - Directory/e-mail/security servers for users - Directory/e-mail/security servers for computers - Directory/e-mail/security servers for applications - System management workstation	EOS Server - e-mail equivalent	Yes	?	N/A
System Engineering				
System Performance 1. Analysis of Needs/Operations Concepts	Existing science requirements document. Draft ops. concepts and science requirements document in work for Radarsat.	Yes - Each project does Sys. Eng. in their own fashion.	In-depth description of the roles of Users and other V0 system elements for each type of IMS traffic. **Various operational documents**	PODAAC Phase A study (FY 95) for ECS needs.
2. Implementation & Performance Tradeoff Studies	In works for Radarsat upgrade.	Yes	**Trade study on archive system performance modelin of DADS**	Rudimentary performance rqmts. and implementation constraints defined (PO.DAAC FRD)
3. Analysis of Major Interfaces - External - Internal (element-to-element)	In works for Radarsat upgrade.	Yes	Planned. Some interfaces to NASA Science Internet described. Architecture & DFDs for Alpha Test V0 system **IRD with SeaWiFS**	Internal (element-to-element) - in FY94 on-line ordering system will be integrated with the physical archive managed by DADS. PODAAC Phase A study (FY 95) PODAAC Phase B study (CDR FY 97) EOS-Alt
4. Prototyping Activity	V0 IMS Server JPL - Ghost Granule Archive (no archive) JPL - planning and user interface	Yes - GLIS is an example of a prototype that went operational.	System modeling & simulation. **User tirekicking of prototypes and releases.**	PGS for NSCAT/SeaWinds.
5. Documentation (e.g., System Design, Ops. Documentation, SOPs, etc.)	Current system - incomplete Radarsat era - in work	Project unique	**Functional requirements** **CM Plan** **CCB-approved DAAC policies** **Manual Pages**	Functional Rqmts Document Functional Design Document CM plan Software Management lOM Integration & Test Plans for Phase I and Phase II system delivery

	ASF	EDC	GSFC	JPL
6. Plans for System Growth/Evolution	Yes - major plans to support Radarsat and future missions	Yes	Yes	Yes, UWG
7. Change Control			**CM at group and DAAC levels**	Internal CM and change control.
8. Problem Tracking			**RDBMS, custom tool**	Manual.
User Model 1. Classification of Users & Services	Limited, working on user model to define user base.	Yes	Limited. IMS interactions are well defined.	Yes - Statistics of number of users. User profiles, DOTS.
2. Collection of Statistics on User Activity	Orders placed, products distributed - better tools and information model needed	Yes	Collects monthly, # queries, # users, Avg. session (min.)	Yes, via DOTS.
3. Developing Predictive Model of Users	No	Monitors access history	SeaWiFS user model. WG participation.	No
4. Implications for System Requirements - Service loads, response times	Informal only.	Yes	Yes - planned upgrades to meet predicted SeaWiFs user load	Yes, from statistics.
Integration and Test 1. Test Data - Test algorithm (benchmark algorithm) - Simulated data sets (for AM-1 instruments) - Data generators	Testing for GPS and for processor (hardware and software) at JPL Have test data sets from real data. No data generators - have real data	Yes - Use real data to simulate test data. Gets simulated sensor data from sensor developers.	TOVS data generator, SeaWiFS data generator (Level 0 data) SeaWiFS test data (from SeaWiFS project). SeaWiFS data generator?	Will be supplied by flight projects and Pathfinder.
2. Test Procedures for New System Installation	Yes, under development	Yes	Test plans for each new system build	Test Plans for Phase I & II deliveries
3. Simulators - Simulators for ext. interfaces	No Have for internal interfaces.	Yes	DADS model No	No
4. Test Tools - Auto test planning and test management tools - Requirements trace tool - Hardware test equipment - Data reduction and analysis tools - Auto testing tools	No - test tools Requirements trace tool - currently no, but maybe in future. Hardware test - yes, for DAAC unique systems Limited data reduction and analysis tools.	Custom for project, uses Purify and lint.	No	No

	ASF	EDC	GSFC	JPL
5. System Configuration Management	Done by JPL, not system-wide, on a subsystem basis (Transitioning to DAAC)	Yes - For Hardware Control USGS National Mapping Division has a CCB - Ron Parsons (Chief Computer Services Branch) is on it. DORRAN is used by 7 mapping centers has CCB like controls. Government property tags and inventory system for hardware.	Yes **- on a baseline basis:** **- Development** **- System Testing** **- Acceptance Testing** **- Operational**	Yes
6. Configuration Management Tools - Hardware and software	Subsystem unique by developer (JPL) - remote (Transitioning to DAAC)	Yes - Uses the three library level technique, custom software config. tools per project, SCCS and Make. GLIS has capability to download update code to user client at user connect time. TMAX had remote developers used a custom software config. mgmt. package.	SCCS (UNIX Tool?) for software CM AVHRR CM s/w is Concurrent Version System (CVS)	Locally developed scripts. Acquiring ClearCase.
7. Discrepancy/Problem Tracking Tool	Database ARSCR database	Help desk has a problem tracking tool which is COTS called UTOPIA but now looking at a better tool called Fastback. Each project maintains its own problem log.	Software Modification Request (SMR) tracking system	Locally developed scripts. Acquiring commercial CM tools.
Internal/External Interfaces 1. Other Data Centers - Data availability schedule - Data request and orders - Data products - Ancillary data - Search criteria - Metadata - Browse - Cost estimates - Order status	User Services network - manual V0 working groups	Yes Data request, cost estimates Metadata (available for some data sets) Data orders Data products Browse (available for some data sets)	Yes. Data request, metadata, data orders, data products, order status, schedule adjudication. Browse (implemented in latest version for selected data	Yes Data availability schedule, data request, search criteria, metadata, data orders, data products, order status

	ASF	EDC	GSFC	JPL
2. SCF - Algorithm, I&T specifications - Toolkit - I&T test schedule - Algorithm delivery package - Test, special products - Calibration coefficient, QA exchange	- IIAS is a prototype SCF - IIAS provides tools for analyzing and manipulating ASF data by end users. - Testbed for prototyping new science algorithms - Special product generation	Bi-directional flow Landsat Pathfinder is a good example.	Planned for SeaWiFS, 4D assimilation	N/A
3. Other Interfaces - FDF, NCC, ICC, IST, NASDA, ESA - Aster, Landsat	Coordinates with NASDA, ESA, and CSA System developers (JPL, Vexcel, ECS)	Planned activities Level 1 interoperability to several other systems.	National Space Development Agency (NASDA)	
Staffing Profiles 1. System Development Staffing (System enhancements and upgrades, both hardware and software) - Number of DAAC personnel - Skill mix - Shifts worked - Days/week				
2. System Testing Staffing (Development, maintenance/upgrade, regression testing) - Number of DAAC personnel - Skill mix - Shifts worked - Days/week				
3. System Management Staffing (Site management, CM of hardware/software/data, document management) - Number of DAAC personnel - Skill mix - Shifts worked - Days/week				
4. System Maintenance Staffing (Hardware, software, performance analysis/sustaining eng., sys. eng., facility planning, document mgmt., QA) - Number of DAAC personnel - Skill mix - Shifts worked - Days/week				

	ASF	EDC	GSFC	JPL
5. Operations Staffing (Routine processing, cataloging archiving, distribution, reprocessing, sys. admin., accounting, operations analyst, operations training, media lib.) - Number of DAAC personnel - Skill mix - Shifts worked - Days/week				
6. User Support Personnel - Number of DAAC personnel - Skill mix - Shifts worked - Days/week				
7. Algorithm Science Software Development, Integration and Test - Number of DAAC personnel - Skill mix - Shifts worked - Days/week				
HMI		The V0 IMS used GLIS as its foundation.		
Accessibility 1. User Interaction	Primarily Alphanumeric to support minimal VT100 capability. Extended to support graphics, but requires user to support tektronics or more advanced VTxxx series. User must re configure their terminal each time move between graphics & alphanumeric parts of interface. Dial-up.	Yes - see V0 column	Yes. Staff Tools. **CHUI** developed in JAM. Valid lists.	For V0, main interaction is via V0 IOS.

	ASF	EDC	GSFC	JPL
2. User Friendly Features - Multiple windows - Buttons and pull-down menus - Valids list - Help - Consistency - Save and restore - Standardized commands/terms - Meaningful error messages - Acronym expansion - Menu tree diagram - Command language	Yes - consistency, save and restore (limited - user sites only), valids list (limited), help (some) No - mult. windows, buttons, error messages, acronym expansion, tree diagram, command lang. N/A - standardized commands/terms	Yes - has hypertext at the key word level using Hypertext Markup language (HTML).	Multiple windows, buttons and pull down menus, valid lists, help**, dependent valids, preferences**	Yes VO IMS
3. Level of User Ability - Expert - Intermediate - Novice	System - interface requires intermediate to expert user abilities.	No	**No**	Yes
4. Ease of Use	System - interface requires intermediate to expert user abilities.	Yes	Yes **- intermediate, expert**	Yes
5. Use of Color/Fonts	None	Yes	Yes	Yes
6. System Feedback - Status, alerts, prompts, defaults	Very limited	Same as V0, user can give comments at screen level.	help, data entry validation	V0 IMS.
7. Error Prevention/Correction	Limited	Valid lists pop up for pick.	**Valids lists**	V0 IMS.
8. Expert Shortcuts	No	Can save and store query, some use of control keys	Yes	V0 IMS.
9. Information Access - Direct vs. Hierarchical	Hierarchical	Hierarchical Same as V0 - hit list oriented	Direct & Hierarchical	V0 IMS.
Maintenance & Operations				
1. Backup Procedures	All systems have weekly backups - nightly data checkpoints of database, 2 copies of raw data on creation.	Yes	Planned use of one drive of Metrum tape archive device for automated backup of the archive. **DLT backup planned**	Yes
2. Recovery Procedures	Yes, see above	Yes	Planned. Recovery procedures for ORACLE DB developed	Yes
3. Security Controls	Passworded accounts - minimal Cypher lock on control room door.	Yes	No **Yes, passwords in OS and RDBMS** **Key card access to computer room**	Yes

	ASF	EDC	GSFC	JPL
4. Daily/Weekly Reports	Meetings weekly to review status/problems. Reports done.	Yes	No	Yes
5. Level of System Control	A lot of manual intervention	Yes	**Semi-automated**	Manual, with some automation with scripts.
6. Staffing Profiles	Control room - 6 X 24, 1 X 16 GeoData (User Services) - 1 shift X 5 X 8 hrs./day	Yes - 3 shifts, 5 days a week, no weekends, no holidays	Yes	See proposal.
FOS				
1. DAR Processing	Consolidates & submits DARs to foreign flight agencies.	See above - some experience w/ MSS and AVHRR.	N/A	N/A
2. Planning	Schedule acquisition of new data based on user request.	1km AVHRR project requires planning with NOAA.		N/A
Miscellaneous				
1. Other Data Distribution Types	Special purpose CD ROMs generated outside of DAAC. Other data types (incl. aerial photography and a variety of geophysical data sets)		**Special CD-ROMs**	Distribution of data and metadata Distribution of coverage maps for MGDR and distributed with the CD ROM CD ROMs include processing history and QA information Distribution of documentation from an off-line inventory PO.DAAC handles restricted data sets for ERS-1 in a closed archive.
2. Data Dictionary (i.e., using as active data dictionary?)	Yes - upgrading in FY 94		**Yes, used for ESDIS and actively for metadat validation on ingest**	JPL (or ESDIS) developing tools for supporting dictionary access and interchange
3. Design	?			None
4. IMS Configuration	?	Client Server	**Local, but telnet access**	Yes, IMS.

	ASF	EDC	GSFC	JPL
5. Major Data Sets Visible via V0 System or DAAC IMS/Format	All restricted. ERS-1 SAR (closed data set) JERS-1 SAR (closed data set) ERS-2 (12/93) Radarsat (1/95) ERS-1 ice vectors, ice classification, and WAVE products	*TIMS Aircraft (7/94) *NS-001 Aircraft(7/94) *TMS Aircraft(7/94) *AIRSAR (7/94) *AVIRIS Aircraft (7/94) *SIR-B (7/94) *SIR-C (7/94) *Landsat 7 (1/98) *Global Land 1-KM AVHRR both 10 day composite and stitched orbits *Global Change Landsat Data Collection *Seasat	HDF data sets: AVHRR Land Pathfinder (1 product) GRIDTOMS TOVS Pathfinder TOMS - CDTOMS TOMS2 - CDTOMS2 SeaWiFS (20 products) FNOC, NMC, COADS, TOMS Ozone Climatology (SeaWiFS ancillary) AVHRR Land Pathfinder (1 product) SeaWiFS (4 products) UARS CACSST CZCS ATMOS 4D Data Assimilation TOMS TOMS2 LIMS TOVS (non-NASA) AVHRR (non-NASA) TRMM (mid 97) NCDS data sets (existing)	HDF data sets: MCSST CZCS pigment concentration AVHRR Pathfinder SST Wentz SSM/I geophysical tapes Geosat Altimeter Seasat Altimeter Seasat SASS Seasat SMMR Seasat VIRR SSM/I (Wentz) TOPEX Altimeter SDR TOPEX GDR TOPEX TMR ERS-1 (closed data set) ERS-2 (12/93) NSCAT (2/96) All the above, as stated in the 'Blue Book' product listing available from User Support Office, plus any future additions to the Blue Book list.
6. Tutorials and Help	No	Yes, on-line	Yes, on-line for IMS interface	None
Operating System 1. UNIX - Major platforms/element	Yes, IIAS (SCF) processor, GPS	UNIX is current standard, several older vendor specific systems still supported	Yes, SGI IRIX.	IMS ported to UNIX from VMS in early FY 94 DADS - only partially UNIX in FY94.

This page intentionally left blank.

Appendix B. Version 0 Functional Analysis Matrix for LaRC, MSFC, NSIDC, and the ESDIS V0 System

Version 0 Functional Analysis Matrix (July 1994)

Revision 8

SDPS	LaRC	MSFC	NSIDC	V0 System
System Access & User Registration 1. User Registration - User authentication - User profiles	LaRC V0 IMS has a single publicly-available account for both the GUI and ChUI. UWG advised against additional password protection. User information is stored by a combination key of first name, last name, and phone no. in the Informix database. The user information includes name, phone #, fax #, affiliation, mailing address, e-mail address, and country of residence.	User Registration and Authentication - TBD User Profile matches ESDIS IMS.	Manual registration & via V0 system level IMS interface.	Will be included by 7/94 User authentication will be included by 7/94 - user profiles captures name, address, affiliation, e-mail address, provides easy system access and current inf. on Welcome screen. Input inf. for user profile primarily for ordering preferences such as user, shipping, and billing address. Self registration will be available at each DAAC for system level. No central registration. User Services will coordinate user keys between DAACS for billing purposes.
2. Dumb Terminal Support - Dial-up - Network connection with terminal	ChUI interface. Dial-up access via LaRCNET. No dial-up via EOS Local (i.e. LaRC V0 network).	Yes, a character oriented interface	V0 system IMS ChUI only	V0 has a ChUI and it is kept current with the latest release level.

	LaRC	MSFC	NSIDC	V0 System
3. Executive Function - Higher level menu that provides single access to all ECS applications	No higher level menu.	Not a V0 Function.	Not a V0 function.	All access is through the IMS menus. There is no access to PGS or other related functions. 2 major functions: GO TO and SCREEN FUNCTIONS plus HELP V0 IMS is a metadata search function only (nothing to do with PGS) - V0 PGS functions are DAAC unique - V0 ingest functions are DAAC unique
Algorithm Integ. & Test 1. Tools - Standards checkers (coding standards, PGS toolkit use) - Code checkers, static/dynamic/performance analyzers - Resource management tools - Development environments (compilers, linkers, debuggers, etc.) - CASE tools - Data checking tools - User interface	SCF: standards checkers: locally-modified version of ftnchek; development environments: compilers for FORTRAN 77, ADA, and C; CASE tools: recent experience with Software Through Pictures; Graphics/statistics tools: locally-developed GRaphical Analysis and Statistical Package (GRASP); Analysis tools: Khoros image processing software, IDL, Matlab, Mathematica. DAAC: development environments: compilers for FORTRAN 77 and C, Informix database. Analysis tools: PV Wave.	Will be available: - SGI Code view - SGI development tools - RCS for code management - Spyglass Transform, HDF Collage	Limited LAS (from EDC), local code from CCAR will be used (calibration & geolocation)	Currently no function for algorithm integration available and do not believe there is any plan for a user interface to be added

	LaRC	MSFC	NSIDC	V0 System
2. Procedures - Algorithm delivery procedures (New algorithms, Updates to existing algorithms, Updates to calibration and other data files) - Documentation of procedures - Formats/templates for reports, test plans, and other required documents - Creation of algorithm metadata	EOPS: ERBE Operational Processing System: An integration and testing account is provided to the ERBE DMT to build executables (PGE) for delivery to the PGS production environment. At the request of the ERBE Configuration Management group, PGS operations staff run scripts to move new versions of the algorithms and/or ancillary data files from the I&T account to the production account. Configuration Management of the ERBE code, scripts, and ancillary data files, is handled by the ERBE DMT. The UNIX utility SCCS, in conjunction with the Informix data base, comprises the ERBE Configuration Management System. DAAC is assisting in operating procedures for ERBE Operations System (EOPS). DAAC has recently developed a Tape Order Processing System (TOPS) with which User Services manages the production of tape media orders.	Insofar as the Data Submission Procedures apply. Informal procedures in place to test & integrate alg.	Strawman developed, followed by iteration through PoDAG to get recommendations, revisions, etc.	

	LaRC	MSFC	NSIDC	V0 System
SDPS Scheduler 1. Automatic and Manual Scheduling of Processing, Data Distribution - Automatic scheduling software - Manual scheduling procedures	For pre-V0 DAAC, scheduling was performed mostly manually. A PC-based database and a mainframe database (RIM) were used to manage the tape inventory (input , output, and blank tapes) and manage a list of potentially-executable jobs. A subsystem analyst provided a request for job submission that includes the necessary runtime parameters. Software generated an executable batch file, but a human operator, via a ChUI interface, selectively submitted the jobs to the CDC Cyber mainframe based on resource optimization. Along with the output of scientific results, quality control reports were generated for analysis by the analyst. With a successful job request, the analyst updates the dual database. This mechanism serves to manage the data dependencies between subsystems of the ERBE data processing system. Manual scheduling for data distribution.	Manual procedures & UNIX utilities.	Manual, ad hoc scheduling of resources (computers and people).	N/A

	LaRC	MSFC	NSIDC	V0 System
SDPS Scheduler 1. Automatic and Manual Scheduling of Processing, Data Distribution (continued)	For V0 DAAC, scheduling is performed mostly manually. An Informix database is used to manage a list of potentially-executable jobs. Unlike the above scenario, GUI and 4GL ChUI interfaces are available. Human operator continues to make scheduling decision. Batch file capability on the UNIX workstation is provided by Sterling Software's version of NQS. Necessary runtime parameters stored in PGS Informix database by SCF. PGS executes jobs based on scheduling information in PGS database and human optimization decisions.			
2. Staging/De-staging of Ins/Outs - Software/Procedures for staging processing inputs and destaging processing products	Staging of ERBE Level 0 data to the PGS is operator-driven using automated procedures. These scripts are implemented in scripts. Operator-driven using automated procedures for de-staging lo data, ancillary data, high level ERBE science products to DADS are used.	Manual & automated procedures	Manual procedures	N/A

	LaRC	MSFC	NSIDC	V0 System
3. Task Initiation - Software/Procedures for initiating processing per a schedule	Crontab job used to automatically catalog (identify/quality control) ERBE Level 0 data received electronically from NOAA/NESDIS.	Manual or CronTab	Ad hoc	N/A
4. Communications w/ SMC	No	No	N/A	
5. Communications w/ EDOS/Pacor	NOAA/NESDIS electronically transfers ERBE Level 0 telemetry data daily. GSFC electronically transfers ERBE Level 0 telemetry data (telemetry and ephemeris) .	No	N/A	
6. Communications w/ FDF	No	No	N/A	
7. Processing Control Language - Scripting language tailored for running processing algorithms	UNIX scripts	UNIX scripts	No (previously used one with CDMS; menu-based)	
8. Publishing Production Schedules - Software/Procedures/ Formats for publishing planned production schedules for the rest of the user community to persue	Productions schedules for ERBE were tracked by the flow of paper authorizations (pre V0 DAAC). Currently published by ERBE DMT (not a daily schedule). User Services uses a new in-house tool (TOPS) to track the production schedule for filling tape media orders. None of these schedules is currently accessible by the user community (V0 DAAC).	Manual	No	

	LaRC	MSFC	NSIDC	V0 System
9. Messages to Production Monitor Personnel - Messaging software, types of messages which have proven useful	Manual procedures and informal format.	Manual procedures	No (previously done with CDMS)	
10. User Interface - Any kind of specialized user interface tailored to scheduling personnel	The EOPS has a ChUI & GUI . The TOPS has a GUI interface.	No	No (ChUI with CDMS)	Function is transparent to user
11. Error Handling/Recovery - Software/Procedures for recovering from aborted product generation due to errors, crashes, etc.	No	Manual procedures	Manual procedures	
Information Search 1. Directory Search	User Services System (GUI for DAAC staff) was developed using rapid prototyping. It is a hypertext viewer for directory information (uses Mosaic). Supported by server to ESDIS IMS clients.	Local and V0 System IMS Supported by server to ESDIS IMS clients. Will also provide local directory function that stores DIFs from the GCMD.	Supported by server to ESDIS IMS clients. Will continue to use the GCMD to store its DIFs.	Provides searches to all the DAACs. Directory searches are routed to the DAACs that are relevant. The V0 client sends requests to the DAAC, the DAAC translates the request to DAAC terminology and then sends back pointers. Sometimes get duplicate results if parts of the directory entry are handled by more than one DAAC.

	LaRC	MSFC	NSIDC	V0 System
2. Inventory Search - Core metadata - Spatial queries - Complex queries (i.e., the use of “not” (user defined), “and”, or “or” in the query) - Dependent valids - Coincident search	Langley V0 IMS supports spatial search using map. A coverage map was created. For both GUI and ChUI interfaces, supports core metadata, complex queries, and dependent valids. Coincident search is planned. Also supported through V0 System IMS client.	Local and V0 System IMS - GUI & ChUI (later) - Using ESDIS IMS client for GUI. - core metadata will update client with "super granule" concept, will not be supporting metadata about data quality for all data sets - spatial queries same as ESDIS IMS No complex queries other than the implied “and” and “or” in the interface, however developing data miner for value based metadata.	Through V0 system IMS	Searching can be performed on time, space, parameters, sensors, platforms, data centers, browse availability, data set, processing level, and day/night flag. Spatial queries can be expressed as global granules, point/radius, and bounding box using a map. Dependent valids are implemented locally with the client using a public domain database called gdbm. Allows construction of queries through various “valids” lists selections are shown in a scrollable field on search panel, provides map projection to create spatial def. for various shaped areas and gives readout of coordinates, valid lists are filtered based on other query selections (seems to be very well done and should provide a good baseline for ECS...from an HMI perspective) - complex queries not currently available...in plan??? Coincident search not currently available...think they are planning to add the LaRC timeline function so will have a temporal basis for function. Have the ability to restrict the number of granules that will be returned

	LaRC	MSFC	NSIDC	V0 System
3. Guide Search	V0IMS & LARC IMS perform guide search via Mosaic-like interface.	Local and V0 System IMS - Using ESDIS guide server and populating - WWW & WAIS access to guide documents	Through V0 system IMS. Developed at NSIDC. Accessible via V0 system level, WWW, & WAIS (will be available 7/94)	Provides access to guide documents through Guide Inf. button on valid list screens and by searching the guide for text strings. Prototype developed, additional work in progress
4. Guide Development - Tools for creation of guide		Basic screen editors (vi)	Guide Authoring tools for creation of HTML documents will be provided to all DAACs.	
5. Reference Search - Algorithms, calibrations, etc.	Planning on a documentation tracking system for User Services.	Provide ref. search through guide function.	Have reference database in library, plus GCMD references.	Would be provided by the DAACs in the guide data.
6. Display Results - Coverage map - View details - Showing coincident results	Search results are provided as an abbreviated display of granule information with a "details" button. Pre-processed display in browse. Plans for regional searches. Provide capability to create order selection list. No coverage map for resulting granules; however, simple map coordinates are provided. Details can be displayed. Not showing coincident results. Added new field experiment data (not global) that allows spatial searching in Langley V0 IMS Version 2.0.	Local and V0 System IMS - view details same as ESDIS IMS Display missing data indicator on results screen (local IMS). Display result as granules or supergranules (local IMS).	Through V0 system IMS	Shows small number of fields (not dynamic). Coverage map shows one granule at a time, granules can be paged through one by one. View details shows all relevant data for a granule. Multiple sorts can be applied to the results such as date and time that will group coincident granules together in the results list. Provides list of data sets that can be marked for detail, browse, integrated browse, FTP browse, and order. Can overlay area of results on map projection (but only displays on specific maps). Detailed inf. provides time and location...more??? No showing coincident results

	LaRC	MSFC	NSIDC	V0 System
7. Data Set Specific Search Parameters - Search on attributes related to a specific data set (i.e., path row)	Currently none, but may be needed to support field experiments.	Local (non-VOIMS), parameters avail.	System level IMS does not do data set specific search.	
8. Data Set Specific Results	Available for FIRE & GTE data sets.	Local and V0 System IMS Using comments field in local & V0 IMS.	Through V0 system IMS	Suggested form for data set specific results is to embed attribute = value phrases in the comments field. The comments field is viewed in the view details window.
9. ADC/ODC Inventory Interoperability	No	No	NSIDC does not currently use any automated interfaces with any of the NOAA sites. When a user requests data of any type not distributed by NSIDC from user services personnel at NSIDC, they are referred whenever possible to the appropriate data center. This applies to all known data centers, whether NASA, NOAA, or any other agency or institution. There are plans underway for NSIDC to become part of NOAA's gopher/Mosaic site, which would start an automated advertising and referral link between NOAA and NSIDC for NOAA-owned data (also from the 'user pull' side).	Working on prototypes w/ NOAA and ESA (CINTEX experiment)

	LaRC	MSFC	NSIDC	V0 System
10. Design Documents - Edits have the ability to search design documents in general	No capability to search	No	No (NSIDC has not developed any toolkits).	User's guide exists for previous release--needs to be updated for recent 9/93 release. Documents available off-line
11. Browse - Ability to query browse data - Ability to display browse data	Browse viewer in Langley IMS Version 2.0 permits scrolling through all images of an SRB, FIRE, SAGE II cloud HDF browse files.	Browse products available - some data sets. Provided the initial ESDIS browse request software and is working on upgrading to request multiple browse images with one message. Only provide standing browse orders to WetNet users. The distribution of real-time browse imagery to a specified group of WetNet investigators continued in 1993. In July, this was implemented as an automated process. Investigators now receive the previous day's browse products. each browse image linked in the metadata tables to its corresponding data granule. HDF browse access via WWW.	Integrated browse for SSM/I. AVHRR, SMMR, ice motion vectors will be integrated. May be graphics-based browse in future (e.g. for rawinsonde, buoy positions, others). Sea ice concentrations available on CD ROM or via FTP (product is also browse).	Browse data can be requested in an interactive mode or an FTP mode. Displays browse product in window with reference map and zoom/scroll capability. Can mark for order from this panel
Archival Product Requests 1. Product Requests - Product orders - Media/Electronic - Spatial/Parameter subsetting - Standing orders	Yes, via IMS GUI and ChUI, User Services, or ESDIS V0 IMS. Spatial subsetting, but not parameter subsetting (study in progress). No standing orders.	Manual & standing orders - will provide ordering of pre-packaged data sets without going through an inventory search.	Manual or through V0 System IMS.	Communications about orders are currently handled through e-mail. This is DAAC dependent, no custom products can be ordered. Can request orders from all DAACs. Each DAAC may fill the order in a different manner.

	LaRC	MSFC	NSIDC	V0 System
2. ADC/ODC Product Orders	Standing Orders with NOAA/NESDIS and GSFC. Currently utilizing electronic interface . For data request and orders: NOAA and GSFC pushes data to PGS and provides processing reports as a contribution to metadata.	Through V0 System IMS.	Manual (referral to data source) or through V0 system IMS	
3. ADC/ODC Browse	No.	Manual referrals	None	
4. Distribution Authentication - Checking authorized users for restricted data sets (How?, Custom or COTS?)	No restricted data sets at LaRC and no data set-specific characterization of the user's authenticity.	User services, manual procedures	Manual or through TRAK, the NSIDC local system.	Any authentication of orders is done at the DAACs.

	LaRC	MSFC	NSIDC	V0 System
5. Order History (i.e., What is tracked per order? Stored in DBMS? Available reports? How long is it kept?)	The IMS collects statistics during a user's session and stores them in an Informix database. The User Services Utility accesses the database during their analyses. The statistics collected by the IMS are: login number: the quantity of users that log into the IMS, order number: the quantity of ftp and tape orders requested, order number by type: the media-type-specific(e.g. 4mm, 8mm, ...etc.) quantity of orders requested, search number: the quantity of inventory search attempts, browse number: the quantity of attempts to browse via the Result Window (GUI only), help number: the quantity of attempts to access the Help mechanism, new user number: the quantity for new users that leave a name and phone number. Reports are generated monthly. No reports have been deleted.	Yes, report from Data Order Tracking System (DOTS) Order history stored in database, can be tracked per user or per data set.	TRAK system documents user data requests. TRAK (before 10/94): dBaseIII-based; reports are run manually every month; reports and data files are kept indefinitely; access is limited to PC (self-contained system); data not replicated except for items reported to ESDIS Project on monthly basis TRAK (after 10/94): will have similar capabilities, but will be Ingres-based, with ChUI interface. Some statistics will be recorded by system level IMS.	
Processing Request Services				
1. Ancillary Data Sets for Processing (i.e., stored, displayed, queried)	Seasonal snow maps used for ERBE data processing system.	No	Manual or through V0 system IMS. (Treated like any other data.)	

	LaRC	MSFC	NSIDC	V0 System
2. Ancillary/Aux. Data Limits Checking & Pre-processing - QA of ancillary data - Reformatting - Regridding	Neither checking nor pre-processing, DMT for each project has the responsibility for ancillary data reliability, reformatting, and regridding.	No	Range checking & validity checking for SSM/I. (During routine production)	
3. Level 0 Data Validation - "Generic" validation of Level 0 data prior to processing	ERBE production software currently performs quality control on the ERBE Level 0 data on PGS.	No	AVHRR L0 validated upon ingest as part of routine browse production.	
4. Processing - Standing order product processing - On-demand product processing - Changes to standing orders - Priority processing requests - Quick-look processing - Reprocessing - Recovery procedures	Neither standard order nor Quicklook nor on-demand product processing. Priority processing and reprocessing performed annually.	Standing order is WetNet processing. Software implementations for the approved SSM/I derived products, such as Sea Surface Wind Speed, Atmospheric Liquid Water Content and Atmospheric Water Vapor.	Routine production, plus special processing upon request.	
5. Metadata Creation/Uploading/Updating - Creation of inventory metadata during processing - Uploading of metadata to IMS - Updating of existing metadata (e.g., updating of QA flags after manual QA)	Most metadata operations are manual. GUI interface for entering and updating Metadata on IMS data base (i.e. MPU software). Development of automated metadata generation for some of the ERBE processing on PGS is complete.	Automated & manual.	Automated via scripts; data set specific.	Transparent to user

	LaRC	MSFC	NSIDC	V0 System
6. Product QA	Yes, some product QA is done based on established process. (limits, tables) Science products and Quality Control reports are made available to the ERBE DMT for Science Quality Assurance. Automated data inspection tools have been developed.	Yes, for certain high priority data sets: SSM/I Automatic QA s/w to check the quality of each Daily granule -- performs statistical analysis, checks for missing data, outputs selected values for visual spot checks.	Manual checksum of file sizes; creation of browse products; visual inspections; SSM/I does comparisons of certain regions to establish baselines to detect anomalies. Automated QA software -- expert system under development.	
7. Processing Tracking, Logging, Reporting		No - not for processing.	Combination of manual & automated procedures. Simple log files (enclosed).	
8. Collection of Mgt. Data - Fault detection and reporting	Hardware failures are tracked manually.	Yes, manual procedures & DOTS.	Minimal, as required by data set documentation. H/W failures tracked in log book (hardcopy). No fault detection. Maintain H/W and S/W configuration.	
9. Multi-DAAC Orders - Data obtained from more than 1 DAAC to be used in product generation or to satisfy a user request	No	No. If a portion of a data order requires data from another DAAC, the customer is referred to that DAAC. MSFC User Services also alerts the other DAAC, giving them the customers name.	V0 system splits requests into separate orders.	Manually coordinated via User Services Working Group.

	LaRC	MSFC	NSIDC	V0 System
Manage Storage System Service 1. Send Distribution/Staging Status - Manual override of distribution priorities - Tracking/reporting Distribution Status and history - Distribution status provided upon request - Verify/check distribution correctness	Distribution and staging status shown in IMS. User Services Utility permits staff to rack user information via GUI. Yes, some ancillary parameters are stored, may not be a comprehensive list.	User services, manual procedures. Users will be able to track order status through local IMS. Provide coordinated user services for cross DAAC ADC/ODC ordering. Data Order Tracking System (DOTS)	Manual (system IMS has no data tracking system; Local IMS will have it.) Currently none; will come through TRAK.	
2. Report on Resource Conflicts - Take corrective measures when network performance impacts distribution - Manage contention for storage system resources	Automated FTP system reports problems to system manager via e-mail. No corrective measures prescribed. No management of contention.	Yes - manual system.	No	
3. Manage Element Resource Utilization - Alternate between tape units to minimize overuse of any one tape unit	Resource element management is not automated.	No	Yes, schedules will be maintained for resources and priorities established.	
4. Generate Accounting Inf. for Distributed Data - Generate distribution reports - Cost and billing information	Accounting information is not needed (no charge for data), but currently tracking basic statistics.	No money handled	Through TRAK, with standard V0 reports generated monthly (standard V0 reports).	
5. Monitor Status of Storage Systems - Performance	Manually monitor UniTree logs (activity). Analysis for debugging purposes only.	Manual procedures, supported by SGI Tools	No	
6. Collect Storage System's Operating Statistics - Performance - Security - Fault	Manual procedure for fault statistics collection. Only event descriptions are collected. No formal report cycle.	Manual procedures, supported by SGI Tools	Yes, manual log book. No reports generated.	

	LaRC	MSFC	NSIDC	V0 System
7. Storage System's Operator HMI	UniTree command interface. Combination of shell scripts and GUI for operations personnel to process orders	No - through FY94. Yes, JAM developed GUI (FY95)	None planned (standard UNIX interface).	Unknown
Toolkit Services 1. PGS Toolkit - File I/O tools - Error/status reporting tools - Process control tools - Ancillary data access and manipulation tools - Time and date conversion tools - Math and modeling support tools - Constants and unit conversion tools - Graphics support tools - I&T support - Platform data simulation tools (ephemeris)	See the ERBE library software, named ERBLIB, from the ERBE data processing system for file I/O tools, error/status reporting tools, time and date conversion tools, constants and unit conversion tools, maybe others.	Yes SGI tools Yes WetNet provides McIDAS & HDF RCS.	No	Not available???
2. IMS Toolkit - IMS server API for update, query, DBA utilities	GUI interface for entering and updating Metadata on IMS data base.	Yes Oracle tools.	ODL parser for queries; ABF for DBA utilities; looking at INGBBA	
3. Data Visualization - 2D & 3D plots - Earth coordinate cursor - Contour plots - 3D surfaces - Image manipulation	General HDF/NCSA tools to develop in-house software. Other COTS products (Spyglass, Transform, PV-Wave...etc.) for visualization. DBA utilities: Informix database-provided.	NCSA Collage Spy Glass Transform LinkWinds		Some limited capability to pan and zoom
4. Geographic and Geophysical Overlays (i.e., embedded in data or visualized at runtime?)	No overlays unless embedded in the products.	Yes, in WetNet/McIDAS Orbit model display software	Yes, for SSM/I products (separate files overlaid at runtime) (Land mask, coastline, lat./long.)	
5. Production Management Toolkit			None	

	LaRC	MSFC	NSIDC	V0 System
Communication Services 1. Bulletin Board	No bulletin board incorporated into LaRC V0 IMS. No bulletin board on any of the hosts of the LaRC V0 network.	No	No local BB; access and update to Omnet/POLAR and Omnet/OCEAN BBs. NSIDC does not provide IMS users with access to these BBs.	V0 bulletin board not available from the IMS user interfaces. - first screen in IMS tells you system news
2. User Feedback - Facility for user to enter comments - Facility to ask questions of user about tools	LaRC V0 IMS provides a comments window for user's on-line feedback, monitored by User Services. LaRC V0 IMS has a News feature which provides information about new data sets available via the IMS. Some data set-specific mailing lists have been established.	Yes - through user services. User comments through local & V0 IMS.	Manual or through V0 IMS (client has comment feature)	Ability to enter comments at any time from the GO TO menu. On-line user feedback capability
Distribution Service 1. Distribution Media	Pre-generated CD-ROMs (with "read and display" software on 3 1/2" floppy) are distributed. 4mm, 8mm, 9 track, FTP, hard copy for documentation and VHS tape for the ERBE movie.	Yes, all required V0 media will be supported 9 trk tapes,8 mm, magneto-optical cartridges, FTP, 1/4" tape cartridge.	9 trk, CD-ROM, Exabyte, 4mm, 3480 cartridges, floppy disk, FTP. (All required V0 media will be supported.)	Not a V0 System function.
2. Distribution Formats - Format conversions - Quick-look products	Read software is provided for the conversion of the following archived data products formats: 1) HDF to ASCII 2) ERBE data format to ASCII 3) ISCCP to ASCII 4) FIRE to ASCII	HDF for some data sets, native for others No format conversions	HDF, ASCII, native formats	
3. Prioritized Distribution - Process data transfer delay or cancellation	No	Under refinement	Yes, occasionally to support algorithm development.	

	LaRC	MSFC	NSIDC	V0 System
4. Browse Storage - Browse archive characteristics	Browse products (e.g. ERBE S4, FIRE, SRB and SAGE II) are distributed in the same manner as data sets. Available through Langley V0 IMS, stored in HDF.	Yes. HDF Raster images, GIF and McIDAS browse images are archived.	AVHRR data stored on tape; browse on optical WORM; SSM/I also different; browse in HDF; data in native Browse available through V0 IMS FTP staging; data on media	
5. Subsetting/Subsampling	Prototyping spatial and parameter subsetting for HDF.	Software available for users to subset SSM/I level 1b & Pathfinder data.	Evaluated on a case by case basis (considered special processing).	
6. Push vs. Pull of Data Distributed to Users	Once completed, user is sent e-mail on the Internet to pick up data.	For electronic (ftp) distribution of data there are two methods. If the customer provides an ftp drop address, and requests a data push then that is done. Otherwise the data is staged to the DAAC anonymous ftp server and the customer is notified to pull it from there. All other data orders (tapes, etc.) are mailed when they are ready. The WetNet project automatically pushes browse images to its customers on a daily basis.	Notification to users upon staging to FTP; others planned when jukebox comes on-line (status will route through user services).	
7. Read Software	Available for HDF data sets (on-line), also distribute read software contributed by Data Set Producer for native formats.	Yes, Pathfinder & WetNet, NESDIS level 1b & Wentz data.	HDF specific tools. IDL tools. Data set specific.	
Application Program Interface (API) Services 1. Local User I/F	No	No	No	
2. Metadata Searching	No	No	No	
3. Guide	No	No	No	
4. Archive API	No	No	No	

	LaRC	MSFC	NSIDC	V0 System
Data Acquisition Requests 1. Orbital Model Display - IMS portion of DARs - DAR submission	None	No	No	Not available through IMS interface
Statistical Collection for LSM 1. Monitor IMS Usage (i.e., what statistics are kept and how are they implemented?)	User Services manually tracks IMS usage. IMS collects the following statistics during a IMS user's session: login number: the quantity of users that log into the IMS, order number: the quantity of ftp and tape orders requested, order number by type: the media-type-specific(e.g. 4mm, 8mm, ...etc.) quantity of orders requested, search number: the quantity of inventory search attempts, browse number: the quantity of attempts to browse via the Result Window (GUI only), help number: the quantity of attempts to access the Help mechanism, new user number: the quantity for new users that leave a name and phone number.	User Services collects statistics on all customer requests. Data orders are tracked with DOTS. Additional statistics are maintained manually. Media & ftp distributions are tracked. Customer history information also maintained.	TRAK and IMS are used to collect statistics, including: user name, address, ship-to address, phone, email, fax, type, data set code, media code, # media, description Information requests: data set or product (or group code); referral information (if data is not local); phone #, email, letter contacts (note: "documentation sent" is counted as a data request); time spent to fill request (both data and inf.); specialist's initials For charged orders: purchase order #; invoice #; amount billed/date; amount received/date; bill-to address	
2. User Access Patterns (i.e., what and how?)	None	Yes, user history database is kept.	Through V0 request log (tracks who, what, and how long).	

	LaRC	MSFC	NSIDC	V0 System
Ingest Service 1. Basic Electronic & Tape Ingest - 8mm - 6250 bpi - CD ROM	9 track, 3480, 4mm, 8mm, 3 1/2" and 5 1/4" floppy, FTP, and CD-ROM.	Yes, for 6250 bpi, CD-ROM, electronic, 4mm, and 8mm tape. If a data producer has data on any of these media, the DAAC can accept and read it.	Yes, 8mm, 9 trk, CD-ROM, 3480 cartridge, 4mm, FTP.	Transparent to user
2. Media Formats - Tar, backup, ...	Varied, UNIX systems. Read software is required.	TAR, BRU, ISO9660, ANSI tapes.	TAR, flat files, hierarchical file directories.	
3. Data Checking - Media readability - Checksum - Check format - Check data ranges	Inspection performed to check limits and verify documentation. Anomaly reports generated for data producers to reconcile discrepancies.	Limited: Number & size of copied files are checked.	Manual (checksum and comparison of file sizes.)	

	LaRC	MSFC	NSIDC	V0 System
4. Receive HDF & Native Formats, Format Conversions	1) HDF to ASCII 2) GEMPRO to ASCII from NCAR 3) Enhanced Binary Universal FoRmat (E-BUFR) to ASCII from World Meteorological Organization 4) Standard Data Format (SDF) to ASCII from the First ISCCP Regional Experiment (FIRE) 5) ERBE data format to HDF 6) SAGE I and II to HDF 7) ISCCP to HDF	Yes, the DAAC will accept data in any format. Most of the data has arrived on tape media. In the process of populating the Optical Mass Storage System, several data sets have been reformatted. The SSM/I data from Remote Sensing Systems (Frank Wentz), the Wentz Ocean Products, and the SMMR data have been, or will be, converted from large multi-day files to smaller daily files. Individual orbits were extracted from the large files and collected into a daily file using the UNIX 'tar' facility. Each daily file contains just the orbits for that day. The individual orbits remain in their native format. The SSM/I Pathfinder Project has converted SSM/I data from the native (Wentz) format to HDF. Once again, daily files are produced. Data exists for the period 8/87 through 11/88. All data has been reformatted. None of the original native structure remains. Reformatting of data is determined by the service level given to the data. Level 4 and 5 data are reformatted. Below level 4 is native.	Yes Image or gridded data: filtered through HDF utility (SSM/I, FII) Data set specific Near-term exercise using NGDC's Freeform for conversion	

	LaRC	MSFC	NSIDC	V0 System
5. Data Compression Techniques	Standard UNIX compression used for Level 0 and ephemeris data that is then stored on CD-Recordables. This data is not distributed to users. Browse images are compressed using NCSA compression techniques.	Data set dependent. Data compressed when archived, distributed compressed or uncompressed. Large data sets like SSM/I are compressed with Limpel-Ziv (UNIX) compression. Other data sets are not compressed at all. The data sets that are being migrated to the Optical Mass Storage System are typically compressed. It is possible to employ JPEG or RLE compression for the SSM/I browse images using built-in HDF utilities. At present, the DAAC is not using those compression schemes although some experimentation has taken place in cooperation with the V0 IMS development. Customers can request compressed data sets. In fact, the larger data granules are only distributed in compressed form. Again, if the data is given a high level of service (4 or 5), the data will be converted, given adequate resources.	GNU Zip is used to compress SSM/I and TOVS 3 data sets. Data is uncompressed before distributing to user. User may request compressed data, but this is not a standard option.	

	LaRC	MSFC	NSIDC	V0 System
6. Metadata Generation on Ingest - File location or file identification - QA status	Metadata is generated manually. Developing automated methods for ERBE and SRB processing on PGS. File location or identification: path for read software, and master directory id. QA status: yes.	Manual for data set inf. procedure. Automated for granule inf.- file id for all files, file location for files on jukebox. QA status for SSM/I Pathfinder data. Submission procedures are being designed to ensure that data sets submitted to the DAAC will include a scientific description of the data set and instrument source, the software to read the files, the data volume, the processing documentation and history, and sufficient information available to permit the creation of metadata. SSM/I data & limited inf. for MSU, WSI & GDS data sets.	Yes (generated from headers of data products). Yes, file location and file ID; only include QA status if data producer says what the values are (not S/W generated)	
7. Receive Metadata, L0-L4 Data Products, Instrument Data - Schedules - Status	Scheduled reception of NOAA/NESDIS ERBE Level 0 data, and GSFC ERBE Level 0 data. Metadata and other data products manually scheduled. Status updates procured manually.	Yes, the DAAC will accept data in any form that is available. We accept it but do not convert it, except as described above.	Yes, data set dependent. No schedules.	
8. Scan Hardcopy for Ingest - Data or documents	Neither.	No	Text scanning/OCR for documents planned.	
9. Request Re-transmission of Missing Data	Manually.	Manual procedure	Manual	

	LaRC	MSFC	NSIDC	V0 System
10. Push vs. Pull of Received Data	NOAA/NESDIS ERBE Level 0 data-push; GSFC ERBE Level 0 data-pull. For ingested data with eventual availability to the user, data is most frequently pushed.	For some data sets. Pull from NESDIS.	Pull AVHRR data from EDC; also push to EDC. All data is pulled from FTP.	
Archive Service 1. Import & Export Physical Data - Manual or automatic remove/add of media to archive) - Recover data from failed devices and media	3480 tape capability has not been implemented. DAAC has 1-off CD-ROM production system. Concerning failed devices or media, received data is immediately backed up to the institutional MASSTOR system. Concerning removal/addition of media to archive, LaRC version of UniTree is deficient since it does not allow for archived media to be shelved (i.e. physically removed from the archival device) and remain in the archival directory (i.e. no 'archival fault' to force operator to retrieve infrequently referenced data from the shelf).	V0 functionality: A CD-ROM pre mastering facility was added to the DAAC in April 1993. The MSFC DAAC is able to pre-master CD-ROMs either on 8-mm tape or a write-once read many "CD-WORM" after which the CD-ROMs may be massed produced by a commercial manufacturing facility. (p) Procurement is underway to add 4-mm DAT drives to the system.	Tape and floppy import/export; some FTP as well.	
2. Automatic Copying/Refreshing of Media - Manage media degradation	Operations staff is migrating all ERBE science products from the Aquidneck WORM system to 5 1/4 optical jukebox using UNIX scripts.	No: Thus far all MSFC Data Sets have another source of deep backup.	Copying/refreshing is done, but not automated.	
3. Integrated FSMS to Manage Archive	Yes - UniTree	SUNCOAST	SUNCOAST (SUNCOAST provides primitives which applications use.)	

	LaRC	MSFC	NSIDC	V0 System
4. Verify Data is Present & Accounted for	Manual audits	Manual procedures	Yes, manual.	
5. Deletion of Archive Data	Follow recommendation of UWG.	Yes, after the approval of UWG.	Yes, rarely (usually due to reprocessing)	
6. Data Archive Integrity Check	Mostly manual procedures, but some tasks have been automated.	Manual procedures	Manually	
7. Backup for EOS Data - On-site - Off-site	No off-site backup of Version 0 data. Separate backup of products on DISC jukebox on institution mass storage system in same facility.	Yes, for some data sets	All NSIDC data sets are backed up off-site at NOAA's NGDC facility.	
8. Restore Archive		Yes, from backup tapes	No	
9. Capacity to Ingest 3x Normal Ingest Volume in 1 Day	3x Normal Ingest volume in 1 day for current demands (i.e. NOAA/NESDIS and GSFC).	N/A	No	
10. Monitor Bit Error Rate (BER)		Yes, within SUNCOAST software device driver.	SUNCOAST device driver does it.	
11. Stored Data Format - HDF - Native - Some other format	HDF and native	Yes, HDF and native	Native, HDF (browse)	
12. Monitor Archive Performance	Some performance monitoring available from UniTree.	Yes, System Tools	Planned reporting of ingest & access activity.	
13. Prioritized Data Retrieval - Browse, quick-look, standard products assigned different priorities	No	Based on prioritized order filling.	No	
14. Track Access to Specific Data Granules	Track read-accesses that are attributed to orders. Write-accesses are limited to a single UNIX account.	No	Planned for mass store system; data on media is not tracked to granule.	

	LaRC	MSFC	NSIDC	V0 System
15. Archive Hardware	DISC, Inc. optical disk jukebox. Data is stored on 1.3 GB read-write platters. Double-sided jukebox has 3 drives on each side and at total capacity of 1024 platters. Interface to ERBE Acquidneck Optical Platter Jukebox (122.3 GB of storage).	Cygnet Optical WORM jukebox (1.2TB)	Cygnet WORM jukebox (1 TB). (Converting from 9 trk tape)	
CSMS				
Communications Network Infrastructure 1. Network Components - Gateways (X.400/SMTP) - Routers - Hubs - Circuits (site-to-site, i.e., including DAACs and selected ADCs and SCFs) - Dial-up access	Internet access through LARCNET, 2 cisco routers (primary AGS +, backup Cisco 3000), Ethernet (twisted pair, one segment) LAN (192.107.191.xx, "EOS Local"), 168 kbps link to GSFC, dial-up access to LARCNET, no dial-up access to EOS Local.	168 kbps link to JPL 256 kbps link to EDC 504 kbps link to GSFC Ethernet LANs 1 cisco router (plan to have a backup router in FY94) The center has an X.400/SMTP gateway (FDDI upgrade Q1 95)	V0 network: 256 kbps link to MSFC, 2 cisco routers (primary and backup), Ethernet LAN. Local network: SNOWGW cisco router to C.U. (gateway), ethernet LAN, plan to add an FDDI LAN (4 machines).	See GSFC's links and routers. The process of establishing the DAAC to DAAC network is non trivial (a lot of time and energy was spent by the V0 group). No mail gateways. Dial in for out of band access of routers only. Regular dial in for users may be supported by the institution where a DAAC is located

	LaRC	MSFC	NSIDC	V0 System
2. Network Management - Security - Performance - Network monitoring - Performance tuning & analysis (file transfer timing) - Browse applications time	Routers managed by V0 NOC at GSFC. Security and Network monitoring: general scan of every packet using NNSTAT public domain software. Performance and performance tuning and analysis: none.	Computer and network operations done by the computer system administrator and his assistant Routers managed by V0 NOC at GSFC	Routers managed by V0 network and CNS. (CNS manages routers that link to CU)	DAAC to DAAC network managed by VO NOC. The network management software is a DEC MSU (Management Station for Ultrix) The DEC MSU is currently running on a DECStation 5000 and an X-Windows terminal is used to interact with it. An Operations Guide has been developed by the V0 Network group. It contains among other information troubleshooting flowcharts and instructions. Software has been written (few line code) to get key statistics such as free memory, number of users, number of jobs, bytes per day transferred on links between sites and time required for pings between sites.

	LaRC	MSFC	NSIDC	V0 System
3. Basic Communications Services - Directory (e.g., DNS, X.500) - Data compression - Network security (authentication, authorization, address filtering, sub-network isolation (e.g., FOS LANs), card key security for remote ISTs) - Session (GUI type) - Xterminal support - Remote terminal support - File transfer support - Interprocess communication - Time synchronization support - E-mail - Remote data (distributed file system, DBMS client/server) - Remote process invocation - Bulletin board	FTP, Telnet, e-mail (SMTP), session(GUI type), Xterminal support	FTP/Anonymous FTP, Telnet e-mail (SMTP & X.400) transmission of user's request for multiple FTP browse images in a single client/server message. Compression for browse images GUI and ChUI support WWW Server	FTP, Xterm support, e-mail, telnet, remote terminal, file transfer, data compression, data staging for FTP pickup, OMNET, SMTP.	FTP (anonymous FTP supported), telnet - Limited access usenet Bulletin Board - e-mail, listserv (mail exploder), mail reflector - X.500 Directory Service
4. Protocol Suites - TCP/IP, GOSIP, DECNet	TCP/IP, no GOSIP, no OSI, insignificant DECNet.	TCP/IP, HTTP	TCP/IP, DECNet (going away 6/1/94)	TCP/IP
Local Site Management 1. Fault Management - Alarm processing/display - Vendor diagnostics - Event logging and analysis - Expert-system analysis	No alarm processing/display, no vendor diagnostics, no event logging, no expert system analysis.	Troubleshooting, responding to problem reports (human) On-line problem report templates.	Trouble shooting DEC MCC (MSu) for net, system logs, FTP logs	
2. Network Configuration Management - Resource, logistics, policy & proc., maintenance, and inventory management - Software distribution (incl. toolkits) - Event logging and analysis	Informal manual procedures for resources, logistics, policy and procurement, maintenance, and inventory management. No cross-DAAC functions. No event logging and analysis.	Loading new version of software. Testing and integrating new hardware and software. Coordinate maintenance upgrades. (all of this is not automated. Standard Unix utilities are used)	Connecting new machines, inventory & maintenance management. UNIX PS command (processes) DEC MCC (network) SUN traffic command	

	LaRC	MSFC	NSIDC	V0 System
3. Acct./Accountability Management (Including billing systems) - OS account-data extraction - Event logging and analysis - Production/data status tracking	No billing systems	Data Order Tracking System (DOTS) is used for monitoring outstanding data orders	V0 machine has (disk usage) accounting now.	
4. Security Management - Event logging and analysis - Limited key management - Virus checks - Key mgmt. for private e-mail	Limited security management. Periodic password checker executed. Macintosh virus checking. Internet worm patches.	Automatic authentication by IMS/DADS interface software as part of order tracking	Yes, manual through system logs (FTP logins, etc.); virus checkers for PCs.	
5. Performance Management - Event logging and analysis - Logging application perf. - Trending and stat. analysis - Load balancing	No formal performance management.	System performance analysis is performed manual & UNIX SES Workbench software used for simulation of user interaction with the system	Yes, limited. Manual monitoring with UNIX utilities. No trending.	
6. Report Generation - Analysis of event logs - 4GL reports	No formal report generation.	Currently only minimal reports are produced. There are forms for user statistics from User Services that pertain to system use from an order filling perspective. Operations keeps an eye on performance and disk usage on an occasional basis. There will be numerous reports generated when the Data Order and Tracking System goes on-line. The addition of a Systems Management personnel will result in more formal procedures in the near future.	No No increase in data collection anticipated.	

	LaRC	MSFC	NSIDC	V0 System
7. Scheduling - Timeline creation/display		Manual scheduling done for activities such as use of tape drives and backups (no automatic scheduling mechanism)	No	
8. Servers and Workstations - Directory/e-mail/security servers for users - Directory/e-mail/security servers for computers - Directory/e-mail/security servers for applications - Local system management workstation	IMS: HP 735, DADS: RS 6000/560, and PGS: Sun SPARCstation 10.	2 Silicon Graphics hosts	IMS file server (SGI 340D); DECstation 5000/240 is IMS server (local) IMS client will be SGI Indigo SGI Challenge for ingest/production	DECStation 5000 for network monitoring SparcStation 10 for X.500 directory server, anonymous FTP
Non-Local System Management 1. Scheduling - Multi-site schedule monitoring - Cross-site schedule coordination and adjudication	N/A	N/A (if requested data is not available, users are redirected to other DAACs using e-mail and phone)	Paul Buster, Doug Carey CNS@CU. handles these (Communications and Network Services).	
2. Fault Management - Cross-site data aggregation - Alarm processing/display - Vendor diagnostics - Event logging and analysis - Expert-system analysis	N/A	N/A	Manual, as needed	
3. Network Configuration Management - Cross-site data aggregation - Training, resource, logistics, policy & proc., maintenance, and inventory management - Enhancement rqmt. processing - User feedback processing - Source code control system - Event logging and analysis	N/A	N/A	Manual, as needed	

	LaRC	MSFC	NSIDC	V0 System
4. Acct./Accountability Management - ECS-wide status tracking - Product pricing and user billing - Accounts payable/receivable - Transaction proc. - OS account-data extraction - Production/data status tracking - Event logging and analysis	N/A	N/A	Manual, as needed	
5. Security Management - Key management - Event logging and analysis - Virus checks	N/A	N/A	Manual, as needed	
6. Performance Management - End-to-End network - Event logging and analysis - Logging appl. performance - Trending and stat. analysis - Load balancing	N/A	N/A	Manual, as needed	Cross site monitoring of the performance of hosts and routers is done.
7. Directory Information - User identification - Facility and equip. id - Data identification - User registration information	N/A	- MSFC has a domain name server. There is also a new system which allows all of us to specify our e-mail address as: firstname.lastname.msfc.nasa.gov. The system adapts if we change workstations. - X.500 directory service	No	X.500 directory service (currently about 1200 entries of people affiliated with EOS)
8. Report Generation - System-wide analysis of event logs - Cross-site 4GL reports	N/A	No	No	
9. Network Help Desk	User Services	User Services	Comm. staff	

	LaRC	MSFC	NSIDC	V0 System
10. Servers and Workstations - Directory/e-mail/security servers for users - Directory/e-mail/security servers for computers - Directory/e-mail/security servers for applications - System management workstation	N/A	No	Same as above.	
System Engineering				
System Performance 1. Analysis of Needs/Operations Concepts	Informal analysis of needs, based specifications on informally-determined performance estimates, considered current work station performance. Ongoing planning and analysis for DAAC growth and data set population. Developing Operations Concept Document. Operations manual that focuses on physical operations (e.g. nefric collection).	preliminary Operations Plan	Yes	
2. Implementation & Performance Tradeoff Studies	None	Yes, manual procedures by system engineers as required	Informal	
3. Analysis of Major Interfaces - External - Internal (element-to-element)		Analysis on a case by case basis.	None written	
4. Prototyping Activity	Version 2.0 of Langley V0 IMS (in alpha test). User Services Utility. TOPS. EOPS. MPU.	Data miner.	Yes, (V0 sponsored) Polar browse, guide, server, guide-population, automating QA procedures with AI techniques.	

	LaRC	MSFC	NSIDC	V0 System
5. Documentation (e.g., System Design, Ops. Documentation, SOPs, etc.)	Langley IMS Lessons Learned Document, Granule Naming Conventions Lessons Learned (draft), Langley DAAC Data Set Ingest Plan, Langley IMS Configuration Guide, Langley DAAC Handbook, Langley Compact Disc Publishing Guide (draft).	Ops. Plan IMS server document MDMS Fun. Req. & IMP Plan Mass Store Trade Study CM Plan CPU Trade Study	In progress	
6. Plans for System Growth/Evolution	See FY94 Proposal	Yes, manual activity by system engineers as required	In progress (space, human resources).	
7. Change Control	Manual procedures for change control process.	Manual procedures. Typical CCB approach.	No formal review process. All under control (except ops. procedures); manual control.	
8. Problem Tracking	Detailed but informally organized problem reports.	Partially automated with on-line problem report templates.	System logs.	
User Model 1. Classification of Users & Services	Enhanced ability to collect user classification in Langley IMS Version 2.0. Development of "Frequently Asked Questions" list and examination of comments to identify needs.	Yes, based on manual & automated order tracking & customer history.	Yes, based on user statistics.	
2. Collection of Statistics on User Activity	Capturing statistical information with IMS. Analyzing and reporting statistical information performed by User Services. Currently determining the validity of statistics being collected.	Yes with DOTS and manual procedures.	Manually keyed in, with canned output reports.	
3. Developing Predictive Model of Users	No	No	None	

	LaRC	MSFC	NSIDC	V0 System
4. Implications for System Requirements - Service loads, response times		No	All analysis reported through V0.	
Integration and Test 1. Test Data - Test algorithm (benchmark algorithm) - Simulated data sets (for AM-1 instruments) - Data generators	No benchmark algorithms and no simulated data sets in the strict sense of simulation.. CERES Raw Data Generator (CERDAG) produces a data stream for the CERES data processing system based on ERBE instrument and ERB satellite data (an SCF activity).	None yet. Expect these to appear as LIS/OTD mission nears.	SSM/I had specific test data sets provided by GSFC to verify algorithm conversion. Keep set of queries (43) for testing V0 IMS (directory, inventory, browse)	
2. Test Procedures for New System Installation	Yes, but limited for system-wide test. Procedures for installation and testing of PGS software.	Yes, very limited.	Use test client to send queries to server.	
3. Simulators - Simulators for ext. interfaces	None	No	No (just test client)	
4. Test Tools - Auto test planning and test management tools - Requirements trace tool - Hardware test equipment - Data reduction and analysis tools - Auto testing tools	None	No	As above	
5. System Configuration Management	Manual procedures	Yes, manual procedures	Yes, source code control system	
6. Configuration Management Tools - Hardware and software	Mostly manual. UNIX utility SCCS for ERBE data processing system on PGS.	Yes, RCS only	SCCS (UNIX tool); may evolve to RCS	
7. Discrepancy/Problem Tracking Tool	Manual.	Yes, paper to date.	Yes - use C debugging options to debug	

	LaRC	MSFC	NSIDC	V0 System
Internal/External Interfaces 1. Other Data Centers - Data availability schedule - Data request and orders - Data products - Ancillary data - Search criteria - Metadata - Browse - Cost estimates - Order status	Currently implementing and testing of electronic interface with GSFC for ERBS and NOAA-10 telemetry and ephemeris data, currently a 6250 tape interface. Currently utilizing electronic interface with NOAA/NESDIS for NOAA-9 telemetry. For data request and orders: NOAA & GSFC pushes data to PGS and provides processing reports as a contribution to metadata. Yes. Data availability schedule, data request, metadata, data orders, data products, order status	Yes, but limited to capabilities of V0 System IMS. Automatic ingest of SSMI, WSI & GDS data. NOAA/NESDIS interface (ftp). Distribution of WetNet browse electronically to WetNet scientists.	Mostly manual for mediation of data request services (e-mail, fax, phone).	Yes - data availability schedule, data request, search criteria, metatdata, data orders, data products, browse, order status
2. SCF - Algorithm, I&T specifications - Toolkit - I&T test schedule - Algorithm delivery package - Test, special products - Calibration coefficient, QA exchange	With ERBE and ISCCP input data, the Surface Radiation Budget effort is generating data that is being archived at LaRC DAAC.	e-mail, FAX, FTP	Yes, human interface (CRYSYS, POLES)	
3. Other Interfaces - FDF, NCC, ICC, IST, NASDA, ESA - Aster, Landsat		None	NOAA, University, other NSIDC projects.	

	LaRC	MSFC	NSIDC	V0 System
Staffing Profiles 1. System Development Staffing (System enhancements and upgrades, both hardware and software) - Number of DAAC personnel - Skill mix - Shifts worked - Days/week	4 analysts; 2 B.S., 2 M.S., all 3-7 years; 1 shift; 5 days/week.	5.5 people Mix of BS/Ms 1 shift 5 days/week	3.5 people for development Mix of BS/MS All employees work 5 days/week, day shift (as of 1/1/94) (Numbers do not include DAAC management)	
2. System Testing Staffing (Development, maintenance/upgrade, regression testing) - Number of DAAC personnel - Skill mix - Shifts worked - Days/week	Level of effort: 1 FTE (no dedicated staff) comprised of development staff, User Services, system engineering and science; 1 shift 5 days/week	Level of effort: 1 FTE (no dedicated staff) comprised of development staff, User Services, System Engineering and Science; 1 shift 5 days/week	0 people (integrated w/ previous cell) (Numbers do not include DAAC management)	
3. System Management Staffing (Site management, CM of hardware/software/data, document management) - Number of DAAC personnel - Skill mix - Shifts worked - Days/week	3 "personnel": DAAC manager, system engineer, and 1/2 FTE Administrative support and 1/2 FTE contractor management support; 1 shift; 5 days/week.	2 FTEs Mix of BS/MS 1 shift 5 days/week	2 people (Numbers do not include DAAC management)	
4. System Maintenance Staffing (Hardware, software, performance analysis/sustaining eng., sys. eng., facility planning, document mgmt., QA) - Number of DAAC personnel - Skill mix - Shifts worked - Days/week	2 analysts; both B.S., 1 2-7 years, 1 >7 years; 1 shift; 5 days/week.	6.5 FTEs Mostly BS w/ 1.5 MS 1 shift 5 days/week	3 people (Numbers do not include DAAC management)	

	LaRC	MSFC	NSIDC	V0 System
5. Operations Staffing (Routine processing, cataloging archiving, distribution, reprocessing, sys. admin., accounting, operations analyst, operations training, media lib.) - Number of DAAC personnel - Skill mix - Shifts worked - Days/week	2 analysts; both B.S., 1 2-7 years, 1 >7 years; 1 shift; 5 days/week. 4 Operations technicians; 2 on the day shift, 1 on the 2nd shift, and 1 on the 3rd shift; all 5 days/week.	7.5 FTEs 2.5 BS; the rest are operations technicians 1 shift 5 days/week	1 person (Numbers do not include DAAC management)	
6. User Support Personnel - Number of DAAC personnel - Skill mix - Shifts worked - Days/week	3; all M.S., 1 >7 years, 2 0-3 years; 1 shift; 5 days/week.	3 people; all MS; one w/ 4-5 yrs. and two w/ 1-2 yrs. 1 shift 5 days/week	2.5 people (Numbers do not include DAAC management)	
7. Algorithm Science Software Development, Integration and Test - Number of DAAC personnel - Skill mix - Shifts worked - Days/week	SCF staff only.	3.0 for DAAC 2.5 for Pathfinder 1 has BS w/ 10 yrs; 4.5 have MS	2.7 people (Numbers do not include DAAC management)	
HMI				
Accessibility 1. User Interaction	Version 2.0 of Langley IMS.	Local user interface GUI & ChUI developing WWW Server	Human contact (phone, mail, or e-mail) or V0 system IMS	Easy to access and begin working with system. System responsiveness is slow ChUI has no graphics capability. GUI requires Xwindows/Motif and Internet.

	LaRC	MSFC	NSIDC	V0 System
2. User Friendly Features - Multiple windows - Buttons and pull-down menus - Valids list - Help - Consistency - Save and restore - Standardized commands/terms - Meaningful error messages - Acronym expansion - Menu tree diagram - Command language	Multiple windows, Buttons and pull-down menus, valids list, help, and consistency. Save and Restore user profiles and user IMS queries. Standardized commands and terms. Meaningful error messages but focused upon error prevention when designing IMS. Acronym expansion. No menu tree diagram, avoided deeply nested menu tree (i.e. greater than two levels). No command language, but tried to avoid the need for the command language by providing an interface with the necessary functionality as requested by the users.	Yes, under development based on V0 IMS. WWW HTML documents for most data sets, SSMI browse.	See V0 system description.	New version has multiple windows but take up entire screen and do not facilitate interaction between panels, everything under 2 pull-down menus...some buttons available to pull up other panels, good implementation of valid lists and dependent valids, functions under the "Screen Functions" menu change with each panel...this could be more consistently implemented - limited implementation of help - limited error messages - ?? on save and restore - no acronym expansion, menu tree diagram, and command language
3. Level of User Ability - Expert - Intermediate - Novice	UWG specifically advised AGAINST developing a system with novice and expert modes.	Under development Expert & Novice.	See V0 system description	Expert and novice can be set, but do not think function is implemented at this time
4. Ease of Use	Reasonably easy.	Good, we hope	See V0 system description	
5. Use of Color/Fonts	Well-chosen colors, legible fonts	Yes, but not user changeable	See V0 system description	New version has color
6. System Feedback - Status, alerts, prompts, defaults	Yes, status, alerts, prompts, defaults Minimal feedback.	Under development	See V0 system description	Very limited system feedback provided

	LaRC	MSFC	NSIDC	V0 System
7. Error Prevention/ Correction	Sometimes. For example: valid lists pops up with possible answers, phone number checked for inclusion of area code. Minimal correction, if any.	Minimal	See V0 system description	None
8. Expert Shortcuts	UWG argued against this feature.	Yes	See V0 system description	Command keys can be used in place of menu selections
9. Information Access - Direct vs. Hierarchical	Direct and Hierarchical exist.	Direct for some data sets.	N/A	Access is very hierarchical since options are buried deep within 2 menus and windows cover entire display
Maintenance & Operations				
1. Backup Procedures	Yes	Yes, TAR and BRU onto 8mm	Yes, BRU, dump (system & data) daily, weekly, monthly.	
2. Recovery Procedures	Yes	Yes, from backup tapes	Yes, from backup tapes.	
3. Security Controls		Yes, security plan under development.	UNIX (monitoring rhosts file, yellow pages, etc.)	
4. Daily/Weekly Reports	Yes	Yes compiled manually	Weekly meetings to review status/problems. Building an anomaly database.	
5. Level of System Control		Manual	Crontab to run backups; everything else manual.	
6. Staffing Profiles	Yes, EOSDIS staff works 1st shift (generally 8:00 - 4:30). 1 operations staff member on 2nd shift and 1 operations staff member on 3rd shift.	1 shift/day 5days/week. See proposal for staffing profile.	Yes All 5 days/week; 8 hours/day; no shift work	
FOS				
1. DAR Processing		N/A	No	
2. Planning		N/A		

	LaRC	MSFC	NSIDC	V0 System
Miscellaneous		WetNet Magneto-optical cartridges are restricted.		
1. Other Data Distribution Types	CD-ROMs generated outside the DAAC (ISCCP). Documentation provided by Data Set Producers. Documentation about the DAAC.	No		
2. Data Dictionary (i.e., using as active data dictionary?)	Support ESDIS V0 Requirements	Used for valids list in local IMS.	Ingres-based	
3. Design	Rapid development tools involvement of user services staff in development. Worked with data producers to develop ingest procedures. Work in small teams; 3 people did the entire IMS development.			
4. IMS Configuration		Local IMS directly accesses database. ESDIS IMS accesses server that accesses MSFC database.		

	LaRC	MSFC	NSIDC	V0 System
5. Major Data Sets Visible via V0 System or DAAC IMS/Format	All data sets that are currently available are visible to the V0 IMS. All data sets that are planned for V0 will be visible to the V0 IMS. Current data sets in native format: ERBE_S2 ERBE_S4 ERBE_S4N ERBE_S7 ERBE_S8 ERBE_S9 ERBE_S10 (4) FIRE_CI1 (3) FIRE_CI2 (21) FIRE_CI2_ER2_MAS FIRE_MS(7) GTE-ABA-ELEC-CHEM ISCCP_B3 ISCCP_C1 ISCCP_C2 SAGE1_Aerosol SAGE2_Aerosol SAM2_Aerosol Current data sets in HDF format: ERBE_S4G (14)	Wentz data sets: SSM/I Antenna Temps. (Ta) SSM/I Geophysical Products NESDIS data sets: NESDIS Level 1B sensor counts HDF data sets: SSM/I Pathfinder Antenna Temps. SSM/I Pathfinder Atmospheric Products SSM/I Pathfinder Precip. Product SSM/I Pathfinder Land Products SSM/I Pathfinder Sea Ice Product MSU Monthly Temp. Anomalies Ch. 2 MSU Monthly Temp. Anomalies Ch. 2R MSU Monthly Temp. Anomalies Ch. 4 MSU Daily Temp. Anomalies Ch. 4 MSU Monthly Temp. Anomalies Ch. 23R MSU Daily Temp. Anomalies Ch. 23R MSU Monthly Ocean Precip., Spencer WSR Composite Rainfall Product Native data sets: SSM/I Monthly rain indices over ocean, Chang	HDF data sets: AOBP temp, pressure, and ice velocity grids (maybe by July) DMSP SSM/I (F8)Sea Ice Concentration Grids SMMR Brightness Temp & Sea Ice Conc. Grids SSM/I (F11) Bright Temp & Sea Ice conc. Grids SSM/I Pathfinder (EASE-Grid) SSM/I Derived Snow Products (1994) LEADEX AVHRR polar subset (may not be HDF) Navy/NOAA JIC SIGRID (browse only HDF) Russian (FSU) digitized sea ice charts (browse only HDF) TOVS temp and pressure profiles (polar region) Ice surface temp maps (TBD-may not have) Cloud-cleared (TBD-may not have) AVHRR ice maps AOBP Buoy Positions (not HDF) Arctic Atmospheric Soundings (not HDF - may be translated) SSM/I Brightness Temp. Grids for Polar Regions Fowler's ice motion vectors (TBD)	

	LaRC	MSFC	NSIDC	V0 System
5. Major Data Sets Visible via V0 System or DAAC IMS/Format (continued)	ISCCP_C2 SAGE2_Aerosol SAGE2_Ozone SAGE2_Cloud SAGE2_03_Monthly SRB_Daily SRB_Monthly	OLS Derived lightning product, Goodman MSU Brightness temps. (Tb) SMMR Antenna Temp., TAT Rf Ant. GDS Lightning Ground Strikes AMPR Brightness Temp. (Tb) Multi GOES Precip. Index (GPI) In-situ Global land precip., GPCC In-situ Surface Raingauge Obs., Jaeger In-situ Surface and Ship Obs. Precip., Legates In-situ Comprehensive Pacific Raingauge DB In-situ Amazonia River Discharge, Richey In-situ Hydroclimatology, Wallis et al. In-situ Wetlands In-situ Comprehensive Precip. Data Set for Global Land Areas, CDIAC	J. Zwally ice sheet altimetry data set (not HDF) SMMR-derived snow cover maps ECMWF (T, P, Wind) (TBD) NMC (T, P, Wind) (TBD)	
6. Tutorials and Help	Frame document provides an on-line tutorial w/ screen dumps embedded	No		No
Operating System 1. UNIX - Major platforms/element	UNIX, Macintosh, DOS.	Yes	Everything UNIX based. (No VMS) Administrative functions are PC- or Mac- based	

This page intentionally left blank.

Abbreviations and Acronyms

ASF

ACS	Archived Catalog System
GPS	Geophysical Products System
IIAS	Interactive Image Analysis System
MPS	Mission Planning System
RGS	Receiving Ground Station
SPS	SAR Processing System

EDC

DORRAN	Distributed ORdering Research Accounting Network

JPL

DOTS	Data Ordering and Tracking System
GDR	Geophysical Data Record
IDL	A COTS visualization tool
IGDR	Interim Geophysical Data Record
IOS	Inventory and Order System
QLBB	Quick-Look Bulletin Board
SDR	Sensor Data Record
SWT	Science Working Team

For more information, the following are useful references:

Pathfinder specifications (in progress, University of Miami)
DOTS Specification
IOS Specification
PO.DAAC FY 94 Proposal

LaRC

DMT	Data Management Team
EOPS	ERBE Operational Processing System
MPU	Metadata Populating Utility
TOPS	Tape Order Processing System

NSIDC

ABF	Application by Forms (Ingres)
CDMS	Cryospheric Data Management System
TRAK	Data request, tracking system